

AUGUST 1945

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America's First Aeronautical Magazine
ESTABLISHED 1914

AVIATION

IN THIS ISSUE

ARMING AND FUELING CARRIER PLANES

First-hand story revealing how hitherto unpublicized group helps make 1,000-plane strikes possible.

★

SEADROME DESIGNERS HOLD ACE-IN-HOLE

Capt. C. H. Schildhauer details engineering advantages and requirements for creating flying boat port facilities.

★

DESIGN ANALYSIS OF FAIRCHILD C-82 PACKET

First part of typically complete AVIATION study detailing newest heavy duty cargo lugger.

★

NEW JAP PLANES SHOW IMPROVEMENT

Sketches of Norm and Rex — recon floatplanes — reveal that Nips are still in there pitching.

★

PLANNING THE POSTWAR OVERHAUL SHOP

How to establish the size, layout, and equipment for small and medium fixed-base operations.



PRATT & WHITNEY POWERS THE TIGERCAT

The F7F Grumman Tigercat has joined the fleet — first twin-engined fighter ever to operate off carriers with the U. S. Navy. Built around two Double Wasp engines developing well over 4000 horsepower, it is able to carry annihilating fire-power at tremendous speed deep into enemy territory.



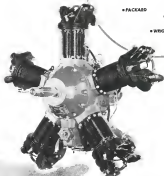
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ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

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Aircraft Ignition equipment plays in the steering pro-

formance of this and other leading aircraft engines.

SCINTILLA MAGNETO

DIVISION
UNITED, N.Y.



Circle 10 "MAGNETO" directory FIVE FIVE TWO

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Bendix
AVIATION CORPORATION

When the history of our Navy's carrier operations in this war is finally written, you'll undoubtedly see plenty of mention of the *Bushmaster* Richard—one of the newest and most powerful of the fast-liners, spelling ruin for the Wigs. Helping to write that history are a bunch of gentlemen among beds who are known as the Service Unit—boys who keep the carrier's planes armed and fueled. *American's* Washington Editor, Bruce Stubbins, was aboard the *Bushmaster* Richard as the leader for the war, and beginning on page 115 he describes vividly just how rugged and vital is this SU work.

Further proof that the boys aboard the carriers still have plenty of work to do is shown by the type of flap planes they are looking out of the sky. On page 174 we present a staff writer's description of two of the newest Shipboard: room jobs—Norm and Rex—which indicate that Rex's boys are still able to make improvements in their aircraft designs.

In another, and much more pleasant, phase of the water-based aircraft field, we're proud to present a detailed engineering story on marine airport designs written by Capt. C. E. Schickelmeier of the Ward Air Transport Service. After citing transportation estimates of airlines, he gives three schemes for their layout as well as specifications for base facilities. And he also considers the docking and terminal facility requirements. Turn to page 136.

Early last month, Assistant Editor Roy Stone moved into Fairchild's headquarters plant, where they're building the new C-42 Porter, to gather material for the 14th in our Design Analysis series. Since this craft is one of the country's newest cargo carriers, and one that presents new trends in design thinking, we are presenting this special study in two parts, the first beginning on page 118 and covering the major airplane components.

At the beginning of the war there were many reports that the Nazis were away out at front when it came to using magnetism in aircraft. "That's no. Per F. A. Reppel, of the Dow Chemical Co., made an exhaustive analysis of magnetism application on German liquid and aerosol engines and in liquid and he found

that even though the Germans evolved many interesting uses of mag and notable production methods, their stuff was no better than ours. His probably illustrated study began on page 144.

Data on how many new type aircraft originating from the British Isles is also presented in this issue—the *Avro Tutor* 1, a four-engine, passenger-carrying job designed for trans-Atlantic operations, and the Miles M-36 *Avroven*, an all-wood twin-engine craft designed for short-haul work. All available details on these two bids for post-war commercial work will be found in the article on page 177.

A lot of publicity has been given recently to crop dusting, so much so that many people think it's an easy and quick way for an airplane owner or operator to make a lot of money. Well, there is good money to be made. But, as is the case with most money-making propositions, the dustier is faced with plenty of things to do—dead plenty not to do. There's encouragement as well as common sense in our dusting story on page 166.

Richard this month in our regular 5-minute department (page 179) is a special article in which Editor Handley continues his precise ranging in market-and-money matters. Title is "Wall Street Tips the Lightplane



JOHN W. MOORE, Traffic Manager for Air Transport of the Port of New York Authority, who presents arguments for a new type of certificate for *low-cost* aircrafts that would give noncommercial flyers in school and sporting planes to take full advantage of current statistics in traffic volume. He details the case on page 171.

Miles." . . . And you'll find another special emphasizing Scintilla in our transport department (page 170). That feature points the previous question, "Is Call Regulation of Airline Securities Necessary?"

Marketing gets its bearings, too—by way of a concise article titled, "Make It Easy on the Prospector." Presented are new wrinkles on getting the product before the customer. See page 168.

Down the Years in AVIATION'S Log

28 Yr. Ago (1920)—McCook: Field tests show aircraft severable after 180 flight-hours . . . Germany tests 15,000 miles for Gellings test job . . . Variable compression powers beneficial in altitude engine experiments . . . Army orders two two-engine-engine attack planes from Boeing.

18 Yr. Ago (1930)—A: flying boat crane is explained by Detroit Air Yacht Club . . . Airplane now flying 155,000 mi. daily, over 8,000 mi. of airways . . . Ford Trimotor is built according Richard Diesel's own designs . . . M. J. State Board of Commerce calls flying boats a menace to navigation . . . Army inaugurates ferrying of similar planes to C. Z.

18 Yr. Ago (1931)—Low: Lavy, of Kellert, and J. G. Egan, inventors, lead airplane carrying trial on road of Philadelphia Post Office . . . Boeing completes Model 299 four-engine bomber (XB-17) for Army . . . Eastern Air Lines orders five Lockheed Electra . . . Delta opens Atlanta-Indian service with Boeing Transcon . . . Northwest Airlines moves headquarters center from Spokane to Seattle . . . State postal bill facilitating aerial photography of military or naval installations . . . Congress passes Wilcox 260 authorizing Air Corps to establish air bases throughout nation and in U. S. possessions at estimated cost of \$14,000,000 . . . Army sends 91 planes to Pacific Coast aircraft.



Now it can be told!

While many of Goodyear Aircraft's products continue to be confidential, we can now release part of the picture of Goodyear Aircraft Corporation at war. More than sixteen different types of aircraft speeded into service! In addition to complete Corsair fighter planes and airships for naval patrol, more than 140,000 major components for other aircraft already produced — all this evidence of engineering, tooling and production ability built up during 55 years' experience in aviation. Evidence, too, of ability to handle assignments the future will bring. Goodyear remains dedicated to the ideal of keeping America first in the air.

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Akron, Ohio • Litchfield Park, Arizona



Some of the new aircraft developed by Goodyear

Major components, types and special types of Goodyear Aircraft Corporation



Eclipse

1511 MOTOR DRIVEN DRY AIR PUMP

OUTSTANDING FEATURES

- ✓ provides air pressure
- ✓ explosion proof
- ✓ requires no lubrication
- ✓ flexibility of installation
- ✓ wide range of application
- ✓ lightweight—only 4.75 lbs.

DESIGN CHECK CHART FOR ECLIPSE TYPE

APPLICATION

✓ The Eclipse Motor Driven, Explosion Proof Dry Air Pump, requiring no lubrication is designed to provide air pressure at various bar for the following applications:

- ✓ Gunner operation
- ✓ Fuel tank pressurization
- ✓ Ignition harness pressurization,
- ✓ Instrument operation
- ✓ Nitrogen gas detector operation,
- ✓ Radio harness pressurization,

PERFORMANCE

✓ The pump provides a theoretical air flow of 8.1 cfm at 15/200 rpm and is driven by an integral 0.2 hp, 27.5 volt dc, explosion proof motor.



Eclipse

LET'S GO "ALL OUT" FOR VICTORY...
BUT MORE WAS BOMBS



1511 MOTOR DRIVEN DRY AIR PUMP

✓ The rated capacity is 0.008 ft³ per min. air flow at 21 in. hg. abs. inlet pressure, maintaining 31 in. hg. abs. discharge pressure.

✓ Maximum operating characteristics, any one of which should not be exceeded, are as follows:

- Current Draw: 15 Amp
- Pressure Differential: 30 in. hg.
- Envelope Temperature: 300°F
- Minimum Flow: 0.01 ft³ per min.

DESIGN FEATURES

✓ Size and design construction designed to fit, operation or replacement in the engine, and provides no flow of oil contamination. The free outlet of discharge eliminates explosion hazard in applications where electrical discharge occur.

✓ Since the pump requires no lubrication, it can be

mounted near its supplementary equipment or in inaccessible places, such as horizontal installation, stored fire, traps, etc.

✓ Pump is a rotary, single vane type, the vane being held against rotor by pressure exerted through dual helical springs.

✓ Rotor rotor bearing discharges heat rapidly.

✓ Includes electrical overload protection, electrical connector (Wing AN-3120-11P).

✓ Lightweight—the unit weighs 4.75 lbs. and measures 4 1/2" long by 3 1/2" diameter.

AVIATION ACCESSORIES

Eclipse-Pioneer Division • Teledyne, N. J. • Los Angeles 36, Calif.



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AVIATION, August, 1941

THE ANSWER TO THE NAVY SCOUT PILOT'S PRAYER! CURTISS "SEAHAWK" with specially designed EDO FLOATS....

In the big, fast and versatile SC-1 Seahawk single-seater seaplane, the Navy has a new and sensational high performance catapult plane for scouting, spotting for gunfire, search-rescue and bombing attack. Powered by the latest Wright Cyclone 9 and

with vastly improved fire power and special bomb compartment for extra uses, the Seahawk flies for faster than former SO types, flies further and higher—with an ease and maneuverability pilots compare with that of a seining plane. Low landing

speed and excellent lateral control aid the pilot in landing and handling in rough ocean water. Action-tested in the June pre-invasion bombardment at Belleau Bay, the Seahawk gives great new power and effectiveness to the "eyes of the fleet", spells grief for Japs on land and sea.



How new design EDO FLOAT contributes materially to the Seahawk's supremacy

Speed—So carefully engineered is Edo's new float, that the Seahawk flies just as fast with floats as with land gear—or "lava foam".

Maneuvering—Pilots say the Edo float-equipped Seahawk handles "just like a land plane" in the air. In the water, Edo design features and water rubbers give exceptional responsiveness to pilot control.

Bomb Compartments—For the first time, bombs are housed inside the float which is fitted with retracting bomb racks. The bomb bay doors are controllable from the pilot's cockpit.

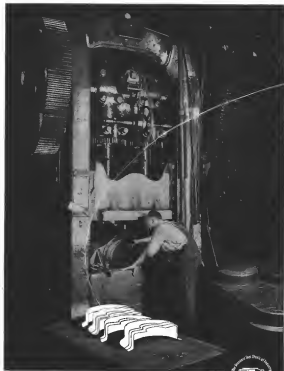
Added Storage—The room that can be loaded with auxiliary fuel tanks instead of bombs.



EDO FLOAT GEAR
SERVES THE UNITED NATIONS

EDO AIRCRAFT CORPORATION, 402 SECOND STREET, COLLEGE POINT, E. I., N. Y.

AVIATION, August, 1941



THE CARPENTER STEEL COMPANY • 125 W. Bern St., Reading, Pa.



How To Make Your Tools & Dies Produce EXTRA Pieces On Each Job...

Getting tools and dies that produce more pieces on each set-up isn't a matter of luck. Here's a practical way to get more output from each tool by reducing machine down time. Use this 3-step plan to increase plant to save money in tool making, heat treating and all along the production line:

1 Plan Tool Performance at the Start!

Here is a sound and proved way to get the most output you want from your tools. With the Carpenter Matched Set Method you can actually plan tool performance before tools are made. For example, when you need greater toughness at most wear resistance on a tool, the Matched Set Diagram points to the tool steel best suited for the job. To take in on its advantages ask for the 107-page Matched Tool Steel Manual. Its handy index quickly shows the way in the pages and steel to meet your needs. For your free copy, drop us a note on your company letterhead.



2 Follow Up With Heat Treating "Know How!"

You know that proper heat treatment will back up your work in making tools that stay on the job. And here is how Carpenter can help you get better heat treating results. The Carpenter Heat Treating Guide provides complete, current heat treating information in easy-to-use form. It gives you forging and normalizing heats, annealing and hardening treatments, recommended drawing ranges for all of the Matched Tool Steels. It gives tips on quenching, drawing and temper atmospheres. For tools that will stay on the job longer and produce more pieces, ask for your free Heat Treating Guide.



3 Check Each Tool's Output on the Job!

How many pieces does it produce between grinds? Did it last too soon in service? Answers to those questions give you a yardstick to use in boosting output from each tool. Start today to check tool and die performance for more output, lower costs. And whenever you want personal help with a tooling problem, call your nearby Carpenter representative. He'll be glad to work with you.



Carpenter **MATCHED** 
TOOL STEELS

BRANCHES AT
 Chicago, Cincinnati, Cleveland, Detroit, Montreal,
 Indianapolis, New York, Philadelphia, St. Louis



They've got a hot date in Tokyo—

Those B-29s are making a front-line battleground of the world's third largest city. Unmatched by the enemy in range, load-carrying capacity or altitude, the big ships are raining destruction on Japan *and* the American craftsmanship and fine American-made materials.

Important among these materials is aircraft wire for ignition, lighting and instruments. Made by Auto-Lite in one

of its 22 great manufacturing plants, this wire is precision-built to perform a here and beyond specifications.

Complete details covering the Low Tension wire are available in Form 438L. Form G-804A describes the famous 7 strand Radiator High Tension wire used in fighting planes the world over. Write for your copies today.

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WIRE IN "CHRYSLER FOR THE ROYAL" BEARING
RACE RANGES—EVERY RUGBY FIELD—NBC NETWORK

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FOUR FREEDOMS IN FLIGHT...

THE SPERRY ATTITUDE GYRO OFFERS FREEDOM FROM
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Now, for the first time, the pilot knows the attitude of his plane continuously, at any flight angle, regardless of visibility or extreme turbulence.

An electrically driven gyro stabilizes a sphere which is universally mounted—without limit stops—allowing full 360 degrees freedom of indication about the roll and pitch axes of the airplane. (The airplane actually maneuvers around the indicating sphere.) No caging is needed!

Pattern indication by daylight or by artificial light gives the pilot a quick, visual picture of his attitude at all times—a single glance tells the story. Thus the pilot can control his aircraft under instrument conditions for long periods without fatigue.

The Sperry Attitude Gyro makes instrument flying safer, easier, and more reliable. Write our Aeronautical Department for further information.

SPERRY GYROSCOPE COMPANY, INC. GREAT NECK, N. Y.



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If you're dealing in tenths of a thousandth



PROTECT IT WITH **MPM*** FILTRATION



Take this Diesel injector nozzle as an example. The fine orifices in the spray tip are precision-drilled to exact tolerances to insure proper fuel injection. Yet unless those orifices are safeguarded against clogging or enlargement by harmful particles in the fuel, the benefits of precision manufacturing are lost.

To filter out these harmful particles, a Moraine Porous Metal filter element—bonded to a metal washer—is designed into the injector. It removes particles whose largest dimension is .001" to .002" . . . from its tortuous flow passages particles which would pass through the finest commercial screen.

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Where perfect performance depends on maintaining the accuracy of hardened parts, Moraine Porous Metal has a lot to offer American industry.

KEEP YOUR BONDS—AND KEEP BUYING

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*MORaine POROUS METAL

A unique material of powder metallurgy, fabricated into efficient shapes and providing controlled porosity for these functions:
Filtration • Separation • Diffusion
Flow Control • Flame Arrestors
Vents or Breathers



Going civilian . . .

Gone are the guards, the "stop" signs, the uniforms, the deep drone of service ships. Gate and hangars are open. Little planes out on the line wear bright colors, others are inside for recovering, paint, engine overhaul . . . Flying is going civilian again! . . . And Air Associates is going with it.

Today, with eighteen years experience distributing standard supplies and equipment, with western knowledge and facilities for the manufacture of specialty components of our own design and engineering . . . Air Associates offers the industry's largest stockrooms to meet the needs of private, commercial and military aviation . . . Four strategically located offices and warehouses, efficiently staffed and adequately stocked with thousands of items, stand ready to give you prompt attention at proper price!

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MR. ENGINEER... *Gaskets* are precision products

...when they are Sirvis leather gaskets. They are made from leathers especially chosen from Chicago Rawhide's vast stock. Each application is carefully studied before recommendations are made in its design, thickness or method of treatment. All Sirvis gaskets are cut on precision dies and are uniformly leveled to exact thicknesses.

Finally, they are minutely examined to assure maximum uniformity and accuracy. When you specify Sirvis gaskets, other special or stock patterns, you also get the benefit of Chicago Rawhide's 67 years experience in engineering mechanical leather.



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*Bring 75% Greater Vision
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P-51 Mustang pilots fly under a protective canopy of transparent Du Pont "Lucite" methyl methacrylate resin. Because of its ability to be heated

and formed into streamlined contours, this one-piece enclosure can be shaped in less time than was formerly required to produce the old-style canopy. This technique also reduces optical distortion during firing. In addition, the plastic "one-wrap" reduces riveting operations and operations on alloy sheet stock as well as eliminating the use of machined parts.

"Lucite" possesses remarkable transparency, light weight, tensile strength and is outstanding among plastics for its weather resistance. WPB-allocated, experimental quantities can be obtained for your test purposes.

Address: E. I. du Pont de Nemours & Co. (Inc.), Plastic Department, Arlington, N. J., or 5801 South Broadway, Los Angeles 3, Calif. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

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BETTER THINGS FOR BETTER LIVING
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LIGHTING



A VIBRATOR POWER SUPPLY

Belongs Here

Fluorescent lighting, made possible by *EL* Power Supplies, is one of the features which will make tomorrow's airlines the last word in appearance, comfort and convenience. Fluorescent lamps not only add to modern beauty, but they produce twice as much light as incandescent lamps of an equivalent wattage. Actual tests have shown that passengers definitely prefer this more adequate and pleasing type of illumination.

Electronic Laboratories has developed current converting systems to convert the plane's own electric power to the proper current for fluorescent light operation. Other *EL* equipment is available for operating radio, navigational equipment, and ultra-violet (black light) instrument panel lamps.

Efficient, Light, Long-Lasting

In all these developments for the aircraft field, *EL* has kept foremost in mind the requirements of reliability, light weight, efficiency and minimum

maintenance. The many advantages offered by *EL* Vibrator Power Supplies are the result of painstaking research and design which has won a tremendous acceptance in the many different fields.

Precision construction and selection of moving parts insure exceptionally long service life. *EL* Vibrator Power Supplies may be protected against dust and moisture and hermetically sealed, when necessary, for operation at high altitudes.

EL engineering service is available for special applications in current conversion for the aircraft industry.

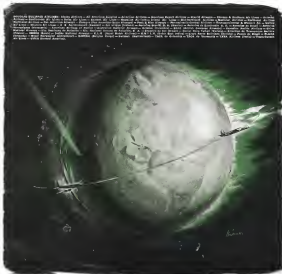
EL Fluorescent Lighting Power Supply Model 2025

Model 2025 operates ten standard 41" fluorescent lamps from the 28 volt DC electrical system of aircraft. Lamps may be individually controlled, and voltage regulated to insure proper lamp operation, regardless of variations in input voltage. It delivers at rates of 30 lumens of light per watt of input power. Dimensions: 14 1/2" x 3 1/2" x 4"



Electronic
LABORATORIES INC.
INDIANAPOLIS

VIBRATOR POWER SUPPLIES FOR LIGHTING, COMMUNICATIONS, ELECTRICAL, RADIO, OPERATING, ELECTRIC, ELECTRONIC AND OTHER EQUIPMENT



The Sun never sets on a DOUGLAS TRANSPORT

...bringing back wounded heroes and carrying fighting men and munitions to men the sides of battles. When the war is over, cruising in excess of 300 miles per hour along the routes of landing airplanes, the giant Douglas DC-6 will take you anywhere over land or sea with comfort, speed, economy, and assurance beyond anything you have ever imagined.



GREATEST NAME IN AVIATION

DOUGLAS DC-6

(Star Ship of the Famous C-54 Combat Air Transport)

An up-to-date summary of the properties of Celanese Plastics

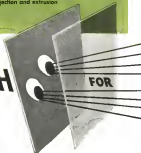
While there is no such thing as an all-purpose plastic, experience proves that the cellulosic plastics are suited to a wider range of applications than any other type. In addition to their outstanding and widely recognized advantages, recent developments and improvements in the celluloses have increased the scope of their usefulness. Within the Celanese group of cellulosic thermoplastics, there are types and formulations which offer physical properties that bracket the full range of cellulosic plastics possibilities.

TOUGHNESS Toughness in the cellulosic plastics is inherent; it is achieved without supporting filler of any kind. Among the celluloses, Celanese plastics are unexcelled for toughness.

UNLIMITED COLOR Sixty years of color experience that began with the first plastic "Celluloid" is the background for the unlimited color and accurate color control available in Celanese plastics. The result is a range of colors, configurations, mottos and color densities that is surpassed by no other group of plastics.

MOLDABILITY Moldability is an outstanding characteristic of Celanese plastics. They are adaptable to the fastest injection and extrusion as well as other molding methods.

LOOK INTO LUMARITH FOR



EASE OF FABRICATION There are, perhaps, more fabricating methods open to Celanese plastics than to any other plastics group. They can be cut, sawed, drilled, heat formed, machined, laminated, blown...

TOUCH COMFORT Low thermal conductivity is the property that makes Celanese plastics pleasant to the touch. They are never too hot or too cold.

SURFACE PERMANENCE Clear-through color, absence of filler and good surface hardness all contribute to the surface permanence of Celanese plastics parts. Usage actually improves their texture and appearance.

NON-REVERBERATING Celanese plastics have pronounced sound absorbing characteristics. Mailed and fabricated articles have no unpleasant clatter or ring.

HEAT RESISTANCE The ability to soften under heat without deforming is the basis of the superb moldability of Celanese plastics. This chemical heat stability is an important part of the resistance of lumarith plastics parts to the higher operating temperatures.

WARPAGE RESISTANCE Lumarith EC (akyl celanese) is the most dimensionally stable of the celluloses. Military applications of lumarith EC have demonstrated this stability both in the dry cold of the Arctic and the humidity and heat of the Tropics.

LIGHT WEIGHT The specific gravity of Celanese plastics formulations range from 1.37 to 1.40—lightness which permits greater bulk and consequently greater strength in many applications.

TRANSPARENCY Celanese plastics rank high in the property of transparency. Light transmission is as high as 98% of the theoretical maximum (92% absolute) for a sheet approximately .125" in thickness. Index of refraction is 1.49. The spectral transmission can be modified to include or exclude the ultra-violet rays. Celanese plastics are not subject to stress creasing that affects strength as well as transparency.

WIDE RANGE OF FORMULATIONS Success with plastics depends upon the right plastic and the right formulation. Celanese welcomes every opportunity to assist you in the selection of the right plastic for best results. Should a study of your product and problem indicate the need of other than a Celanese plastic, you can count on the Celanese technical staff and sales organization for impartial advice. Celanese Plastics Corporation, a division of Celanese Corporation of America, 380 Madison Avenue, New York 16, N. Y.

4040 12-57-58





The Piper Cub biplane—single plane.
40 hp., 110 mph., piston plane.

Looking Ahead with Lear

Piper Cubs were outstanding private planes long before the war. As "grass-hopper" Army-Civilian planes they have won all kinds of accolades on the front lines.

So it's a sure bet that post-war Cubs will bristle with new features developed from a wide successful background.

Speaking from experience, Piper has this to say about Lear Radio:

"Well remembering the part Lear Radio has played in the development of low priced equip-



ment for personal planes, we are looking forward with a great deal of interest to the many improvements they will have to offer after the war."

(Signed)
W. B. John, Sales Manager
Piper Aircraft Corporation

Lear has built high-efficiency, small, light aircraft radios since 1930. They have been standard equipment on many of the most popular types of private planes and commercial airplanes. Constantly improved, they will be ready to provide peace-time pilots with the finest in radio communications and direction-finding equipment.

LEARADIO the pilots' preference

Radio Sales only to:

LEAR, Incorporated — Radio Division, Great Radio Building — Aircraft Radio Sales, 1500 Broadway, New York 21, New York — West Coast Sales: Lear, Inc. at Calif., 650 N. Highland Ave., Los Angeles 39, Calif.



In bearings, sleeves,
machine parts and
various rotating
equipment . . .

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Cut Your Cost per Part

You save two ways on the various grades of Ampco Metal and Ampco Alloy which are produced in standard form at Ampco:

(1) You save on metal.

Since closely parallel metal requirements.

(2) You save on machining time and cost.

These extruded products are produced in Ampco's own large extrusion mill, under the exceptionally close quality control which is characteristic of all Ampco production. Controlled mixing and alloying — most better casting and better heating technique — careful inspection — assure you of uniformly satisfactory results.

Thus you combine the basic advantages of Ampco alloys — exceptional resistance to wear, impact, fatigue, and corrosion — with these plus values of the extrusion method: (a) Good surface finish. (b) Close, sound grain structure of quality approaching that of forged material. (c) Close tolerances — material is machine-as-forged or drawn so as to be suitable for stress machine work.

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Ampco Field Office
in Chicago, Ill.

Only from Ampco can you get all of these services and benefits conveniently:

1. Bridging gaps in all sections of extrusion by using, instead, fabric reinforcement.
2. A series of small sized alloy types — with standard properties — to fit your application.
3. Quality cost of to hold these properties within narrow limits.
4. Diversified production facilities — or drawing in and price of the commonly used metal machine services.
5. Engineering and production knowledge to save you a critical state of emergency.
6. A maintenance or acceptance of field economy in cost per part.
7. A record of standard performance in hundreds of test specimens of same metal.
8. A national reputation that makes Ampco Metal products a sales asset.

• Available in engineering — production — drawing — or inspection of major final shop parts.

ENGLISH FIELD, Amarillo, Texas

"THE FRIENDLY FIELD"
IS A GOOD FRIEND OF PHILLIPS!



Airline Terminal Building, which houses operators, ticketing, and reservation offices for Braniff Airways, Inc., Eastern, Inc., and Transcontinental & Western Air, Inc.; C. A. A. Communications Bureau; U. S. Weather Bureau Station; a Coffee Shop and Dining Room.

FOLKS who fly the Southwest will tell you that (for courteous, personal service and friendly goodwill, there's no place that can beat English Field at Amarillo!)

Staffed with excellent service and a high percentage of flying weather, 35 modern facilities serve an increasing number of private planes.

In addition, English Field handles four scheduled flights of Braniff Airways, Inc. per day, and an average of twenty-six flights of Transcontinental & Western Air, Inc. per day.

We're proud that this "friendly field" is a good friend of ours. Here's why. What others drunk about Phillips Aviation Gasoline and Phillips Service at a diner, they're more appreciative to you than what we think about ourselves. The tip-off on any product is the kind of people and places that use it. We've found ourselves some mighty good friends. Maybe we can be of service to you, too. If you have a problem that involves aviation fuel—write to us at the Aviation Department, Phillips Petroleum Company, Bartlesville, Oklahoma.



above—Panoramic of buildings at English Field showing, from left to right, Airline Terminal Building, Private Pilot's Training Building, Hagan No. 1, and Hagan No. 2.

At left—C. H. Knapp, one of the people who helped make English the friendly field has been Airport Manager for the past 11 years.



Thunderbolt...

Both are all-metal airplanes... Republic Aviation engineers reasoned that if their world-famous P-47 Thunderbolt fighter needed sturdy, all-metal construction, so did their personal amphibian airplanes, the Seabee.

And that's good reasoning. Returning pilots who have won their battles in aluminum airplanes will feel more "at home" in aluminum personal planes.

Use of aluminum in structures and skin permits higher factors of safety without adding weight, fewer parts to assemble, an easier airplane to maintain for the owner. ALUMINUM COMPANY OF AMERICA, 2102 Golf Building, Pittsburgh 19, Pennsylvania.

ALCOA

FIRST IN ALUMINUM

Outer Beauty Reflects Inner Quality



Sleek, new planes, soon to flow from assembly lines for civilian use, will be earmarked for quality by the finishes they will wear. Color styling will be an important feature in civilian plane merchandising . . . color identification and distinctive styling will have a decided effect on customer preference.



BERRYLOID

AIRCRAFT FINISHES

BERRY BROTHERS
Fusils, Varuibus, Enamels, Lacquers & Polishes, Ltd.
Detroit, U. S. A.



*Leading Producers of Aviation Finishing Materials
in War and Peace, for over 30 Years*

Berryloid finishes, famous for 30 years, protect a large share of the planes on Allied battlefronts. These same battle-tested, weather-tested finishes, in less somber hues, will lengthen life, add color and durability to private and commercial planes in peacetime. Those planes whose exterior color styling bespeaks fine craftsmanship, good design and quality materials, will be finished with Berryloid.



Airborne Attack on a Peacetime Foe

Our nation's vast timber lands cover an area larger than the combined areas of France, Germany, Italy, Norway, Sweden, Belgium, The Netherlands and The British Isles. The protection of this huge natural resource against fire, is a responsibility second to none. For fire, America's greatest peacetime enemy, destroys millions of feet of potential lumber annually.

But millions of acres of valuable timber lands and ranges must be saved each year—thanks to the Forest Rangers of the United States Forest Service, and the Fire Warden of State and private

timber organizations. Through a system of lookout towers, they maintain a constant, never-ending vigil—detecting fires, and dispatching men and equipment to prevent such fires from growing into raging, destroying infernos.

In recent years, the helicopter has been used both for patrol and transportation functions—dropping men and equipment by parachute to points adjacent to fires . . . thereby saving precious minutes which may save lives, and millions of acres of timber.

The helicopter, moreover, may be developed to render specialized

aid to the service. Its ability to hover, to fly slowly forward, backward, or sideways, to make vertical ascents and descents, make it ideal for patrol, observation, transportation and firefighting activities as pictured.

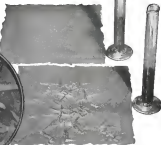
At McDonnell, right now, we're concentrating on the production of planes, parts, and plastics for war. But we're looking forward to showing you, postwar, just how and where the helicopter can serve countless commercial needs.

McDONNELL *Aircraft Corporation*
Manufacturers of PLANE • PARTS • PLASTICS • SAINT LOUIS • MEMPHIS •



"STRIP"

IN A HURRY



Top area — 30 minute test with ordinary stripper
Bottom area — 30 minute test with Kelite A. C. Stripper
Magnified area — shows how Kelite A. C. Stripper lifts old paint from surface.

... THROUGH KELITE pH CONTROL

Comparison proves Kelite A. C. Stripper works faster! The above test run by a disinterested research chemist clearly shows the difference in results gained by Kelite A. C. Stripper and a competitive stripper with a reputation well above average.

Kelite A. C. Stripper penetrates and loosens paint for quick removal. Nothing else will do the same job with equal speed and safety.

A. C. Stripper is used straight at room temperature. It can be applied by brush, pressure sprayer or immersion. It is safe on aluminum, magnesium and ferrous metals.

This is another in the save-losing line of specialized chemicals manufactured by Kelite for

cleaning and processing in the aviation industry. For latest information on Kelite products and the advanced method of pH Control by which Kelite has raised the standards of efficiency in cleaning, send for Kelite Aircraft Stripping Ballots.



**FREE
ILLUSTRATED BULLETIN
MAILED ON REQUEST**

KELITE PRODUCTS, INC.
7001 S. 10th St., Los Angeles,
Calif. Manufacturing plants
in Los Angeles, Chicago,
Pittsburgh and Seattle.
Branches in principal cities.



"KELITE" Registered U. S. Pat. Off., Chem.
Copyrighted 1942 by Kelite Products, Inc.

NEW GREASE STANDS UP UNDER ALL THESE CONDITIONS!



Temperatures from Freezing to 350° F.
If using just one grease will be an advantage in your plant, here's the answer—Gargoyle Severs Grease. This one unique product is an all-purpose grease for plain bearings. It resists softening and is being successfully used in bearings at temperatures of over 350° F.

Light to Heavy Pressures!

You'll find that Gargoyle Severs Grease combines the best features of both lime and soda-lime greases. It serves under light to heavy pressures, and stays on the job where other greases fail. You can apply it with grease guns, mechanical applicators or any way that grease can be applied.

Water from Cold to Boiling!

Many greases withstand cold water. But Gargoyle Severs Grease resists the washing, softening action of hot water, even boiling water. It is also unusually resistant to dilute alkali and acid solutions. Your Socony-Vacuum Representative will be glad to give you detailed performance tests and figures and help you apply this new grease throughout your plant.

SOCONY-VACUUM OIL COMPANY, INC.
Standard Oil of N.Y. Div. - White Star Div.
Lubrizol Div. - Chicago Div. - White Eagle Div.
Williams Div. - Magnolia Petroleum Co.
General Petroleum Corporation of California

SOCONY-VACUUM'S 5 Steps to Lower Production Costs!

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedule and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Control
5. Progress Reports of Results Secured



160 ROUND TRIPS...



and still no
sign of failure

• 160 round trips over the North Atlantic... more than 4000 heater hours of service... and according to the latest from American Airlines, reproduced below, this Janitrol Aircraft Heater is the fastest Douglas Skymaster was still functioning! The plane met a tropical storm. The heater, which was removed for examination, delivered heat to the windshield and pilot compartment. Two other Janitrol heaters, with a combined capacity more than sufficient to heat 3 actual 6-room homes, maintained steady warmth and ventilation for the stranded crew in the large cabin.

Long life and trouble-free operation are typical of the job Janitrol is doing in United Nations planes all over the world. Here are a few of the reasons why this kind of performance is possible:

1. The basic "Whirling Flame" design means even distribution of heat throughout the combustion chamber. No "hot spots" to burn out.
2. Special alloy conduct heat rapidly away and into the circulating air. Keeps heater cool.
3. Turbine main controls result in efficient combustion with a minimum of carbon or lead deposit to impair operation.
4. Continued study of thousands of hours in actual use, and development work in our research laboratories, assure continuous progress in making new aircraft heating requirements.

To help you work out your particular problems in aircraft heating, the results of our experience and our unique facilities are available to you. Write Surface Combustion Corporation, Toledo 1, Ohio, for further information.

Disassembled photograph of 4000 Rm Janitrol heater combustion chamber, and end plate after over 4000 hours of heater operation. (Originally shipped as new replacement of 1980 hours) also assembly has received no reported life to 4 years and is still good for many more hours of heat life.



AMERICAN AIRLINES, INC.
1000 K STREET, N.W. WASHINGTON, D.C. 20004
June 25, 1947

Surface Combustion
Toledo,
Ohio

June 25, 1947

July 25th - 1947

ATTN: Mr. J. E. Bell

Dear Sirs:

We of your Model 400-00000 heaters have been in operation for the use of our C-54 airplanes since we are operating under contract for the war.

This heater, Serial No. 0000000, has been in the airplane since the fall of 1943 and has over 4000 hours of service before it was removed in February 1947. The heater has 4000 hours of service and is still in good condition. It is certain that you will receive the heater in 1947.

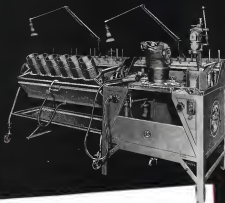
Very very truly,
Albertson & Co., Inc.

Albertson & Co., Inc.

Chicago, Ill.

Enclosed: 1000 Rm
Heater

The One Way to be Sure on
Production or Maintenance



Use
SIoux AIRCRAFT
wet valve seat **GRINDING MACHINE**
for Inline and Radial Motors
Write for Details

STANDARD THE
ALBERTSON & CO., INC.



WORLD OVER
SIOUX CITY, IOWA, U. S. A.

A BRUSH WITH LIFE.

WESTINGHOUSE HIGH-ALTITUDE BRUSHES . . . PRODUCT OF RESEARCH AND EXHAUSTIVE TESTS . . . AID IN PROVIDING RELIABLE ELECTRICAL POWER FOR AIRCRAFT

When dogfights go upstairs, both men and aircraft feel the lack of oxygen, the lowered pressure, and the comparative absence of moisture. Particularly critical spots in aircraft are the brushes in generators and motors. When aircraft first ventured into higher altitudes, ordinary carbon brushes often wore out entirely within a few hours.

Today, thanks to Westinghouse high-altitude brush treatments, operation of aircraft electrical equipment is reliable and has received extensive approval. To bring this about, Westinghouse solved the problem of the disappearing brushes.

In a test chamber that duplicates stratosphere conditions, they established two important facts:



(1) That at earth surface conditions, a lubricating oxide film normally exists on the commutator.

(2) At high-altitude conditions this lubricating film disappears, and the commutator acts as a grindstone.

The solution was direct and effective... they developed a number of chemical treatments for brushes which enable them to maintain this lubricating film under stratosphere conditions... so that high-altitude wear is not materially greater than wear at earth levels.

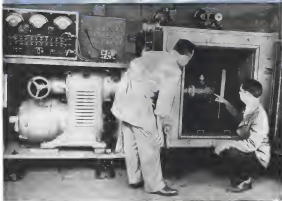
The effectiveness of these chemical treatments is attested by the fact that today over 90% of all high-altitude brushes on military aircraft utilize one of these treatments.

Today, the electrical method of operating important apparatus in aircraft has received widespread approval. There are over 150 motors of more than 50 different types in one B-29 Superfortress alone. Tomorrow, the high-altitude brush promises superior performance for many earth-surface applications where commutation has been a problem. For further information, call your Westinghouse office, Westinghouse Electric Corporation, P.O. Box 888, Pittsburgh 32, Pa.

10000

Westinghouse

... AT 40,000 FEET




Through hundreds of subzero low temperature and low pressure tests such as this, Westinghouse high-altitude treated brushes were developed . . . to provide greater reliability and longer life for aircraft electrical equipment.

The door opens to the stratosphere in this test chamber for Westinghouse high-altitude brushes. Temperature as low as 60° F. below zero, pressures of 1/10 of earth level pressures, and widely varying moisture conditions are accurately duplicated here . . . to simulate stratosphere conditions.



High-Altitude Brushes



MEMO from the desk of the Vice President

Att. Advertising Department

VINCO TAPER RINGS & MASTER PLODS

Accurate to a tenth - superior finish by exclusive VINCO methods - designed to check one of the most exacting of precision parts - the control bushing on airplane propellers - one VINCO item, but it typifies the care, skill and overall perfection that is the mark of all VINCO Precision Products - a powerful suggestion that to buy VINCO is to buy with the confidence that the standard of VINCO Excellence will always be an unflinching standard when future gaging needs are to be met.

[Signature]

MILLIONTHS OF AN INCH FOR SALE BY VINCO

MADE IN U.S.A.

VINCO CORPORATION, 3181 SCHAEFER HIGHWAY, BETHOISE ST., MICHIGAN, SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Tail Rotor Hubs • Propeller Spines and Saw Blades • Optical Master Instruments • Milling Dies • Grinder Cutters • Angle Taps • Radius Drills • Index Plates • Machine Vises • Saw Bars • Straightedge Rules, Extension Tables, Armature Tables, Armature Spines and Index Plates • Ring Gages • Thread Plug, Ring and Sizing Plug Gages • Spur and Helical Module Gages • Module Gages • Pinion Hub Gages • Railway and Special Gages • Spur Rilling Plates • Index and Guide Plates • Radial Power Control, Millstones and Blotting Cloth • Engineering Storage and Development

"Hail ye heroes!
Who fought and bled
Heaven-born band!
in Freedom's cause..."



Never forget this Distinguished Button
—for Manhood's Service to our Country—

Lest we forget, our duty . . .

. . . to recognize, respect and aid those who forsook their loved ones, their homes, their futures, and with stout heart, fearless and determined, defended that which every American cherishes . . .

Life, Liberty and the pursuit of Happiness.

BARRETT EQUIPMENT CO.

The World's Finest Brake Service Equipment
• CASS AVENUE AT TWENTY-FIRST ST. • ST. LOUIS 8, MO.

American Airlines like only Champion spark plugs for delivery to make an easy change-over. The thousands of mechanics and pilots who will make your choice for Champion spark plugs.



Now AMERICAN AIRLINES SPECIFIES DEPENDABLE CHAMPION SPARK PLUGS 100%

American Airlines, Inc., the nation's largest domestic airline—in miles flown, passengers carried and planes operated—now specifies Champion Spark Plugs 100%. This tribute to Champions is directly traceable to "better performance, longer life, less servicing time, and lower operating costs."

Thus once again the qualities which have made Champions outstanding in aircraft

engines, both military and commercial, are confirmed in a service where dependability is the ultimate criterion.

All Champions benefit from the same heritage of prestige and better performance. The same basic materials, research, engineering and manufacturing are back of every Champion regardless of type. Insist on Champions for your plane—Champions in fact as well as in name.



CH—
Registered



Buy them and they
will serve you
the day of history

CHAMPION SPARK PLUGS

USE CHAMPIONS AND FLY WITH CONFIDENCE

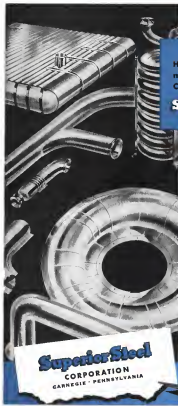
CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

AVIATION, August, 1946

Where
HEAT and CORROSION
must be resisted —
Choose —

Superior STAINLESS
STRIP
STEEL

The ravages of high temperature and corrosion are barred from your products when you build with stainless steel—and when you specify Superior Stainless STRIP Steel, every production advantage is realized. The exact required physical characteristics and dimensions for your needs join with any desired coil lengths to simplify your fabrication problems. Let us detail the Superior answer!



Superior Steel
CORPORATION
CARNEGIE - PENNSYLVANIA

AVIATION, August 1946



Developing the precise structure of a metallurgical solvent required 100 tests

Arming radio for war

MEMBER GLOBAL NATION has subjected radio communication equipment to laboratory solvent of form of punishment. But the test of time in extremes of shock and vibration, the enormous acceleration of high powered aircraft take-offs and the abrupt deceleration of carrier landings.

Each service requires not only a high degree of excellence in design and fabrication, but also an extensive amount of research in the field of avoidance outside and their behavior under varying conditions.

Collins chemical and metallurgical research has



played a very important part in developing the Collins communication transmitters and receivers which have proved so trustworthy in Military service. The result of continuing research will be reflected in the Collins equipment available to commercial users after the war. Collins Radio Company, Cedar Rapids, Iowa, 11 West 41st Street, New York 18, N. Y.



... IN RADIO COMMUNICATIONS, IT'S ...

ADEL AIRCRAFT SOLENOID VALVES


Over 25 types & sizes, including

shut-off  ... 3-way  and



 4-way,



 dual 4-way

plus many special types such as

reversing  & pneumatic 

Standard and special solenoid selector valves to suit nearly every requirement. Each distinguished by the same *Design Simplicity and Dependability* which has created the widespread acceptance of ADEL units throughout the industry. To speed service on your inquiry, please furnish pertinent data on your requirements—port sizes, pressure ranges, flow, DC volts (AC not yet available) and watts, duty cycle, etc. Contact nearest office or address Burbank, California, Dept. S-600.

FOR YOUR BEST INTEREST BUY BONDS



ADEL PRECISION PRODUCTS CORP. • Burbank, Calif. • Huntington 17, W. Va.
1411 South Ave., Seattle 1, Wash. 421 Market St. on Bldg., Boston 1, D. 232 Lexington Bldg., New York 17
436 Michigan Ave., Chicago 1, Ill. 232 Fisher Bldg., Detroit 2, Mich. 100
114 Lexington Bldg., Baltimore, 1, Md. Rep. & Power Eng. Corp. Ltd., Canada
Copyright 1945, ADEL Precision Products Corp.



Finishing is added a batch of production carburetors after Home Carbureting; Fuller Mfg. Co., Kalamazoo, Mich.



HOMO CARBURIZE!

For Uniformity, as in "Fuller" Transmissions

Carbureting which is uniform is of course not new to the Fuller Mfg. Co. Fuller Truck Transmissions have for many years included high-quality carbureted parts. But—the amount of time required for uniform carbureting of shafts was cut in half when Fuller adopted the Homocarb Method! And the labor of packing and unpacking parts in carbureting compound was eliminated.

The Homocarb advantage which save Fuller's time and money are having the same effect in countless other plants, on parts ranging from gears to lock shackles, from drill bits to aircraft fasteners; from first gears to bearings to ball-bearing races to machine-tool parts, and for many other kinds of work. If you have a parts-carbureting problem before you now, an L&N engineer will welcome an opportunity to tell you what Home-Carbureting can save for you. Or, if you prefer a catalog, just write for T-621.

(M Ad 2-222375)



Production parts going directly to shops from carbureting.

In Readiness for the New Planes

Holley production facilities are still engaged in war work, but the postwar period will find these same facilities quickly available to produce promptly, with traditional regard for quality and dependability, a large portion of the aviation industry's carburetor and accessory requirements.

In the future, as in the past, alert engineering and sound manufacturing will provide in Holley Products, maximum efficiency of design and reliability of performance. Look to Holley for postwar leadership.

HOLLEY CARBURETOR COMPANY
5930 VANCOUVER AVE., DETROIT 4, MICHIGAN



HOLLEY

AIRCRAFT, AUTOMOTIVE, MARINE
CARBURETORS AND ACCESSORIES



LEEDS & NORTHRUP COMPANY, 4305 ETERTOR AVE., PHILA. 41, PA.

LEEDS & NORTHRUP

MECHANICAL INSTRUMENTS

TELETYPE

AUTOMATIC CONTROLS

ANTI-FRIGID FUELS

AVIATION, August 1945

AVIATION, August 1945

Meriam Manometer being applied check pressure within altitude test chamber as Westinghouse aircraft motors are being tested

MERIAM MANOMETER

shows PRESSURE in chamber
test of Aircraft Motors...

As tests are under way in this high altitude test chamber, a Meriam Manometer is used on a direct reading check on pressure altitude within the chamber.

The test chamber duplicates conditions of high altitude. Temperature is lowered to check starting conditions. The manometer may be located either inside or outside the chamber, depending upon test requirements.

This Well Type Meriam Manometer is a primary base standard using a liquid in a glass indicating tube—the amount of pressure being balanced by the head of liquid. The manometer range will depend upon the type of liquid selected. Of extremely high accuracy, this instrument is extensively used to measure pressure, vacuum, and differential pressure.

Ask for Bulletin R containing full description

THE MERIAM INSTRUMENT COMPANY
10300 MADISON AVENUE • CLEVELAND 4, OHIO
WESTON DIVISION 242 N. HIGH AVE. EAST RASTOFT 9, SWEDEN
IN CANADA: TRADER BROS. LTD. MONTREAL

MERIAM INSTRUMENT PEOPLE



"Today, I fly an all-metal fighter...
tomorrow, I'll have fun
in an all-metal SILVAIRE!"



NONE less than the best, a good enough for our combat plane. This explains why nearly every fighter plane is of all-metal construction—a means, maximum structural strength—longer service life—and even around using the increased air speed.

Soon, you'll be able to enjoy your own personal plane. Naturally, you'll want it to be all metal. So, look first to Luscombe—pioneer builder of all metal personal planes.

In a handsome, postwar version of the SILVAIRE, Luscombe will offer you a truly fine personal plane reasonably priced... a sturdy, de-

pendable plane that is easy to operate—an all-metal beauty surprisingly low in maintenance cost. Additional information will be sent on request. Merely send coupon below.

LUSCOMBE AIRPLANE CORPORATION
TRENTON 7, NEW JERSEY • DALLAS, TEXAS

Send Varsity, we'll endeavor to make all metal parts and metal cut assemblies for Luscombe's fighter plane. They are not necessary if you want to build your own plane of postwar all-metal light plane fabrication again will be devoted into production channels. The result may mean new planes that will do much toward making tomorrow the age of light.



SILVAIRE
AMERICA'S FIRST ALL-METAL PERSONAL PLANE
BY LUSCOMBE.

you can see the all-metal SILVAIRE in the all-metal SILVAIRE

Luscombe Airplane Corporation
Trenton, New Jersey, Dept. B-15
☐ Please tell me more about the SILVAIRE.
☐ I'm interested in a SILVAIRE design.

Name

Address

City

LIGHTNING POWER Sparked by PACKARD AIRCRAFT CABLE

Packard high-altitude ignition cable has been adopted by the air forces and airlines for applications that demand the utmost reliability in high-tension cables.

The P-18J Lightening, with an operational ceiling of 40,000 feet and a top speed of over 420 miles per hour, must have an ignition cable that can withstand severe punishment. Packard high-altitude aircraft cable carries the surge of high-voltage electricity—safeguards the vital "spark" of engine performance—under all atmospheric conditions from sea level to ceiling.

Packard high-altitude ignition cable was developed to meet extreme conditions. Protected by a tough synthetic sheath over an inner reinforcing braid, Packard cable provides effective resistance to extreme cold, heat, oil, moisture and electrical corona.

Serving in commercial planes as well as in fighters and bombers, Packard has met the challenge of atmosphere flight. Packard high-altitude aircraft ignition cable is available with either copper conductor or stainless steel conductor. You're RIGHT with Packard cable.

KEEP BUYING BONDS



Packard cable serves the armed forces on tanks, jeeps, armored cars, planes, aircraft instruments, anti-aircraft gun controls, landing craft, radio equipment.

THE CEILING IS UNLIMITED!

You're in the aviation gasoline and oil business . . . but are you really ready for the coming tremendous expansion in private flying? With the right kind of station planning, merchandising and advertising help you can build your present set-up into a big-time, big-volume business.



HERE'S HOW SOCONY-VACUUM CAN HELP YOU:

SOCONY-VACUUM's new Airport Dealer Plan brings you a real opportunity to get started now to build national recognition for your airport . . . and a sound, growing gasoline and oil business. This new plan is backed by 70 years' research, refining and marketing experience—premier in the oil industry.

The complete plan includes many outstanding advantages. Find out about them now. Fill in and mail coupon today!

SOCONY-VACUUM OIL COMPANY, INC. and Affiliates, Majestic Petroleum Company, General Petroleum Corporation of California.

CLIP NOW—MAIL TODAY!

Socony-Vacuum Oil Company, Inc.
Aviation Department
60 Broadway, New York 6, N. Y.

Please send me all details of how new Airport Dealer Plan will help me take full advantage of the big post-war airport opportunities.

NAME

ADDRESS

CITY STATE

Investigate Now—the SOCONY-VACUUM PLAN FOR AIRPORT DEALERS



The Complete Help
You Need to Build a Big
Gas and Oil Business!

"INFORMATION PLEASE" sources from Aviation September 1945: 648; Aviation News Service and Refinery News—Monday 9:30 P.M., 9/15/45.

This is the first of a series of advertisements concerning the future of Aviation ... in America



National Security demands Wings

(A FOUR-PART STORY)

NATIONAL Security and Personal Peace ... through Air Power. Words of comfort for the future, but only if the ideas behind these words are put into action! Air Power for Peace instead of Air Power for War will demand freer cooperation ... with Private Citizens, American Business, Government and the Aviation Industry all joining hands.

★ PART ONE ★

John Q. Citron is part of the story. His interest in private flying, his transportation, local air terminals, air strips and air parks, his support of air shows and exhibits, his interest in aviation literature, books, education and research, his participation in aviation organizations ... all these

are specific ways in which he will help make peace through Air Power a reality.

★ PART TWO ★

American Business also will contribute much to the program of American Aviation and Air Power. For aviation shrinks the distance between markets; opens new sales channels; assures closer coordination of buying plans and action in almost any part of the world in a matter of hours instead of days and weeks. And, in the case of helicopters, even to places normally inaccessible by air.

★ PART THREE ★

Government, too ... Federal, State and Municipal ... will play its role. Already many steps have been taken to pre-

pare aviation and Air Power and other steps are under way. Training facilities ... roads and highways ... safety regulations ... encouragement and development of scientific flying aids and international air transportation ... perfection of airport facilities ... creation of organizations charged with promoting aviation wisely and for the benefit of all ... these are just some of the areas in which Government can be said to be a vital part of this story.

★ PART FOUR ★

And ... the Aviation Industry. Under the stimulus of war the progress and technical advancement of the Aviation Industry has been an industrial miracle. The entire industry is dedicated to a continuous of the scientific research which has made America foremost in the Art. Air Bell Aircraft will put into civilian service the skills and achievements identified with the Aviatron, the Kingbird, the Bell B-29 Superfortress, the Avrocanet (America's First Jet Propelled airplane), the producers of our Oriskany Division and the Bell Helicopter. The challenge of Peace will provide us with a stimulus as urgent as the desperate needs of war.

★ Buy War Bonds and Speed Victory ★

MEMBER AIRCRAFT WAR PRODUCTION COUNCIL—PART FORTY, INC.

BELL Aircraft
PACEMAKER OF AVIATION PROGRESS

© 1945 BELL AIRCRAFT CORP.

56

NIAGARA FRONTIER DIVISION
Napier Falls, N. Y.
Cessna (P-35) and Kingbird (P-45) — Flight
Assault — America's First Jet Propelled Plane
The Bell Helicopter
ORISKANY DIVISION
Burlington, N. Y.
Revels Gun Motors and other machine materials
GEORGIA DIVISION
Atlanta, Ga.
Bell B-29 Superfortress

AVIATION, August, 1945

SNAP-ON TOOLS FOR EFFICIENT MAINTENANCE ON POSTWAR GLOBAL ROUTES



Flies of giant atmosphere clippers crossing global routes at 300-mile speed ... Pan American World Airways wants only the all-clear to transform yesterday's "fantastic dream" into dramatic accomplishment. And as in Pan America's earliest pioneering flights, Snap-on tools will play a vital part in these operations. "Snap-on tools have been long preferred for their ready adaptability to the many types of equipment we operate," says Pan American. "So soon will this be true in our future global operations when flights will range from 100 to 2400 miles — 2400 miles non-stop."

Used in maintenance operations by every major airline ... performed wherever planes are built, operated or maintained ... Snap-on tools have won undisputed leadership as the tools of aviation. Write for 1945 catalog of 3,000 Snap-on tools for production, assembly and maintenance.

SNAP-ON TOOLS CORPORATION
3009-W 26TH AVENUE BENDINA, WISCONSIN



AVIATION, August, 1945

57

FLAME STABILITY

at any altitude
up to 40,000 feet



THIS FLUID HEAT UNIT is less than 20" long, weighs less than 7 lbs., delivers 15,000 BTU per hour. Other models up to 100,000 BTU.



These Efficient Combustion Heaters Save Weight for More Pay Load

HIGH heating efficiency with remarkably low weight! Flame stability at any altitude or speed! No moving parts and no noise to elogi! These are among the advantages which Fluid Heat's exclusive Vapor Extrusion Combustion Process brings to aircraft heating. Also behind the development stand Fluid Heat's 17 years of leadership in the design and manufacture of automatic combustion and heat transfer equipment.

Utilizing pre-heated combustion air, this Vapor Extrusion Process accomplishes combustion with an unusually low pressure drop, permitting operation at low ram pressures. It produces a completely superheated flame and therefore gives freedom from lead oxide formation. Flame retention is so positive that flame characteristics are the same under all conditions. And accurate compensation assures high combustion efficiency from sea level to ceiling.

Capacities range from the 15,000 BTU unit, which weighs two ounces shy of 7 pounds, to the 100,000 BTU unit which weighs only 24½ pounds, and these weights include all controls and accessories. Heaters for ground operation are optional for all models, and continuous heating is ensured by automatic transfer between ground and flight phases.

Naturally, you will want Fluid Heat Aircraft Heaters on planes you design, build or equip. Availability for civilian use is controlled by material and manpower regulations, but write us today for the Fluid Heat story. Address: Fluid Heat Division, Anchor Post Power Co., 6148 Eastern Ave., Baltimore 24, Maryland.

fluid heat
AIRCRAFT HEATERS

Today's the time
TO DO
SOMETHING
ABOUT
TOMORROW



GASOLINE
COUPLING



ACETYLENE
COUPLING



OXYGEN
COUPLING



AIR—
OIL—GREASE COUPLING

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COUPLINGS

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productivity half of the world's total capacity. We have what it takes to force prosperity and to enforce peace.

We at Bryant feel that we're part of the new day that's coming. Our record in war links us with great production achievements, from the millionth-of-an-inch precision in the modern airplane engine to the millions of things that we'll help to produce more simply, faster, for less. We urge you to call us in now!



BRYANT CHUCKING GRINDER COMPANY

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Marquette Aircraft Wipers FOR THE POSTWAR CLIPPERS



Photo Courtesy of Pan American World Airways—Douglas DC-4.



Hornet Greeley said "Go West, young man, go West". He was

suggesting the direction of opportunity, adventure and progress in our great country.

Today it is different. The whole world is open to us.

Pan American World Airways have done much to make this possible by their development into the greatest Airways System in the world.

Above you see one of the post-war Clippers Pan American will offer for your future air transportation—for your quest of opportunity . . . adventure . . . progress.

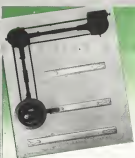
An appreciative and careful host, Pan American will spend millions of dollars for fleets of 108 and 204 passenger Clippers. These will be the most modern of aircraft, designed for safety, comfort, speed and inexpensive transportation.

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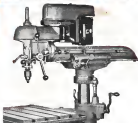


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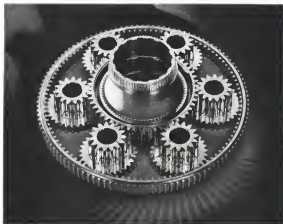
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SPLINED RIVNUT IS EASY TO INSTALL



1. Splined rivnut is inserted in hole previously drilled in the material.



2. Splined rivnut is driven into hole with correct, splined overhead type wrench.



3. Splined rivnut is driven into hole with correct, splined overhead type wrench.



4. Splined rivnut is driven into hole with correct, splined overhead type wrench.

Splined Rivnuts are one-piece, tubular aluminum rivnuts with internally screw-threaded and counter-bored shanks. They're designed for use as a replace for attachment on comparatively soft materials such as wood, plastics, fibreglass and leather. Use as illustrated below in material thinner (diagram a) and thicker (diagram b) than the length of the Rivnut.

Splined Rivnuts are driven into previously drilled and counter-bored holes; the splines bite into the material in which installation is made and provide high resistance to torque. The same simple hand tool also loads the regular Rivnut from one side also (as illustrated to the left), a circular bridge span is formed, which enables being pulled through the material. The threads are completed by the heading operation and remain intact, ready for attachment of accessories.

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FREE! 40-PAGE "RIVNUT DATA" BOOK. Here's the complete story of the whole Rivnut line—clear diagrams—test data—most figures! For the facts about this famous, get "Rivnut Data" now. Just write to The B. F. Goodrich Company, Department AV 8, Akron, Ohio.



(a) Splined rivnut installed in hole in material.



(b) Splined rivnut installed in hole in material.

As the draftsman's pencil makes its mark, he issues orders, through a remarkable kind of shorthand, to the men who start out on his drawings. But only with special assistance can human hands shape such precise, complex orders as these. No wonder the draftsman chooses his instruments with care...for it is, in effect, taking them into partnership!

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THE 25-AMP
SWITCHETTE
"Big" brother of our
little 10-amp Switchette



Size 1 Switchette
Shown Here

THIS new form of G-E Switchette suitable for use at altitudes up to 35,000 feet, and in temperatures from 98.6 C to constant 55.6 C. They resist corrosion and high physical shocks and vibration, and are designed to withstand millions of mechanical operations.

This new (Size 2) Switchette is rated 25 amperes at 24 volts d-c (115 volts a-c). It has screw-type terminals for easy wiring, and is completely enclosed for protection from dust.

Three contact arrangements are available: single-circuit, normally closed; single-circuit, normally open;

and two-circuit. These Switchettes are suitable for use at altitudes up to 35,000 feet, and in temperatures from 98.6 C to constant 55.6 C. They resist corrosion and high physical shocks and vibration, and are designed to withstand millions of mechanical operations.

Approximate dimensions are 3 by 1 1/2 by 1 inch; approximate weight is 2 ounces. Ask your local office for Bulletin GEA-415A, which gives dimensions and complete description. General Electric Company, Schenectady 5, N. Y.

Buy all the Switches you can—and KEEP ALL YOUR BUY

GENERAL ELECTRIC

GE-10000

AVIATION, August, 1945

AND DON'T FORGET

We also have more than 200 forms of the original (Size 1) Switchette, as well as a variety of request (ball) switches, master and selector switches, and other control devices built around this try-out mechanism. The Size 1 Switchette is rated 10 amperes at 24 volts d-c, and its dimensions are 1 1/2 by 1/2 by 1/2 inch. Bulletin GEA 2810 gives complete specifications and dimensions.



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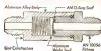


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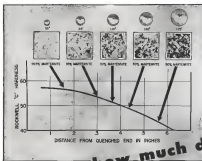
itive sealing. Progressive design has eliminated poppets, hardened and ground seats, and gaskets—eliminating expensive machining and assembly. The result is a service-free valve design of high sealing efficiency, extremely effective at low pressures, yet equally adaptable in high pressures.

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According to our metallurgists it tells at a glance the various degrees of center hardness—varying from full hard to half hard—that can be obtained from a typical oil-quenched alloy steel... and translates them into definite section thicknesses that are readily interpreted in terms of design.

Exactly how much does this chart tell YOU?

SUCH a chart—when fully understood—offers a guide to correct design, can help you avoid costly pitfalls in steel selection and treatment, and should insure optimum performance of the parts in which the steel is used. To a metallurgist this chart is as clear as crystal. But all of us are not metallurgists.

That's why it seems to us that highly informative charts such as this, that are intended to present the latest findings in alloy steel metallurgy, would do a better job in guiding the steel user if only a metallurgist could stand by and explain them.

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Our metallurgists have been right in the forefront of the metallurgical developments that have been fostered by the war. They have materially assisted in the enormous advances recently made in steel application—many of which are well secret. Any assistance they can give you in clarifying that information and in helping you to a better understanding of "what's-what" today in the application of alloy steels is freely at your service.

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1937 Early in January another, Martin, 219 member of the Chinese Air Force returned on leave with 27 fellow pilots in Mustangs. Seeing an answer to the problem of self-starting fuel tanks, Martin redesigned engines.



1940 Army Air Corps produced self-sealing tanks, a "mon." Marmon was too occupied. Marmon engineers had been working on problem since 1932, most 225 manuals. Above, Marmon self-sealing tank, rifled tank bullet.



1942 "Jimmy" Doolittle makes first U. S. raid on Tokyo, his bombers go on the needed range by special Navy cats designed by Mark Abbott. Bombs still in B-25s of type used by Doolittle in his famous raid.



1945 American-led occupying forces in Germany used big water-spraying blaring calls to attract fuel depots. On her way to work, returning to work in 10,000 gallons, she quickly set up an engine for the machine to fuel her workshop.



H H Pears, Managing Director of Reaching Services Ltd, calls savings and defined pension schemes, not back as shippers. Staff and wages saved permits other goods to travel in same container. Investment in new



It's In The Dough Any liquid powder or granular product from powder to wheat flour can be loaded quickly, easily. Tough, dry, or moving soils may be made in any size, any shape may also be loaded the same way.

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May Cut Shipping Costs of**
liquids, powders, grains...anything that pours!

AN entirely new type of container which promises substantial savings in the handling and shipment of liquid, powdered, granular or other free-flowing materials... is rapidly becoming one of the most talked-of packaging products yet to emerge from Martin Laboratories. These containers—known as Marvac cells from the first syllables of the words "Martin Engineering"—are, basically, huge elastic "bags." Designed originally as feed sacks for aircraft, they have made vital contributions to the Allied war effort (see pictures at left)... hold equally high promise as a means of transporting petroleum products.

Library Acknowledgments

Here are some of the advantages offered by the Martin Mariage cells:

- 1 In just a few minutes cells may be fixed into ordinary roadway cars, trucks or barges, thus enabling these vehicles to carry liquid or free-flowing dry materials.
- 2 On reaching destination and end of their concern, cells are folded up and shipped to user. One bonus will hold enough empty cells to load ten barges when cells are folded.

are filled. This can round-trip shipping costs, eliminate backlog of empty tank cars or tank trucks.

- 3 Cells cannot be bent or dented, will not rust or corrode, yield under impact instead of breaking, see lighter and easier to handle
- 4 If punctured, Murrug cells may be quickly patched, thus avoiding soldering or other time-consuming repairs required to patch metal containers.

What We Learned: Recommendations

Busy with wartime production of Martin Man, Martin and other aircraft, the Glenn L. Martin Company has been unable to explore fully the peacetime uses of the Martin oil. If you see possibilities for these classic compounds in your business or in other fields, we welcome your suggestions. Address, THE GLENN L. MARTIN CO., BALTIMORE 3, MARYLAND.



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"Air Power's Role in Peacetime"

by LEROY R. GRUMMAN

President, Grumman Aircraft Engineering Company

"LET'S NOT FORGET our most safeguard of the peace is in *peace*—our power. We must not neglect our own technological and strategic leadership in the air. Though plane production of course cannot continue anywhere near wartime levels, we must have plans for keeping productive capacity overnight—and keep these plans up-to-date. A nucleus of expert management and skilled labor should be kept on tap and kept busy, for any emergency.

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88 DAYS FROM DRAFTING BOARD TO FLIGHT LINE

Germany stunned the world in '39 with their *Messerschmitt*. At exactly the same time another *Messerschmitt* was quietly being made by the Canadians in this country. They needed airplanes and radio communication equipment—fast.

The airplanes they got...and the radios. These were less than 90 days left when Pacific Division got the go ahead for transmission and interphone equipment that had not even been designed.

In 88 days Pacific Division designed—developed—and delivered a quantity of 100-watt master oscillator transmitters for low and high frequency—amplifiers for the interphone—and engineered and installed these and all other radio equipment in the Canadian airplanes.

We at Pacific Division would rather not accept any more orders that we have to pull out of a hat. But we are open for business, especially VHF Communication Systems in which we specialize, that demand experience, ability and resourcefulness. Your inquiries are invited.

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ATTENTION, August, 1945

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BELLANCA *Cruisair*

BUY WAR BONDS

ATTENTION, August, 1945

then he said to himself

"They were Putschovers"

BEING asked why his strong German competitors in Eastern Europe crumbled under the Russian offensive, General Zhukov crashed through with 22 words that will live. They can probably be committed to memory by men who manufacture and sell. Said he:

"OUR strategy was fluid and flexible . . .

THEY were used to easy victories".

That phrase should be visualized and immortalized by some great sculptor.

. . . and inscriptions placed on the desks of sales executives, on paperweights to anchor the following questionnaire:

(a) In disposing of your output during the last 5 years, how many tooth-competing sales fights have you experienced?

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"Fluid and Flexible" . . . he says

THAT, ZHUKOV, is also the battle cry of aircraft manufacturers using Arc Welding to win business victories.



ARC WELDING SOLVES WARPAGE PROBLEM . . . SAVES \$3⁰⁷ PER FAIRING

THE picture shows an exhaust flaring, made of stabilized 18-8 stainless steel sheet and comprising five preformed shapes. Seams must be gas tight.

Originally torch-welded in complicated fixture with water-cooled back-up blocks.

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But tens of thousands of "workhorse planes" will be in there, too! From hundreds of small and medium aircraft they'll pick up the people and packages that "feed" the main airlines. They won't always land and take off on super-runways. They won't always have "jet-set domes" hangar care.

But they will always have to be dependable...



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Behind the scenes in OSTUCO's

plant are the reasons for this universal faith in OSTUCO quality. Rigid testing all along the line to beyond the specification standards... the experienced skill of men who have "grown up" with the seamless tube industry... an outstanding record of on-time delivery... these are OSTUCO qualifications you will want to consider in the highly competitive days which lie ahead.



Bell Aircraft helicopter, open and closed rotors. Other features: Steel Tubing in rotor wings, landing gear and landing gear. Detailed photo of helicopter is shown above at right. Photo courtesy Bell Aircraft.

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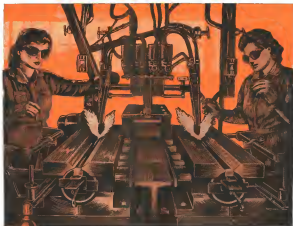
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How Airco Processes Speed



A modern metal working processes are playing an increasingly important part in producing many of the varied parts used in aircraft and automotive manufacturing. These processes have gained wide acceptance because of their speed, economy and versatility—demonstrated in practice and clearly proved during the war.

In addition to the processes shown here, Airco offers those who helped steel-working methods: low temperature brazing, flame-shielded arc welding, flame spurring and flameing, flame strengthening and hard facing. Airco's Applied Engineering Department will gladly provide full information and technical assistance on any use of these versatile processes. For complete details call or write postmaster Air Reduction office, or write to Dept. A at the New York address.

Mechanical Gas Welding offers the important advantages of speed, economy, and versatility of results as the welding of metal parts. This operation shows one of a battery of ten machines used for arc welding steel components. Many other parts are adaptable to perfection by mechanical gas welding set-ups.



Production of Metal Parts

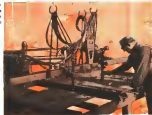


Arc Welding has clearly proven its ability to reform the shape of metal parts while providing maximum joint strength. The aircraft landing gear shown here are typical of the many parts now being fabricated by arc welding.



Flame Hardening increases the surface hardness of metal parts without affecting the toughness of the base metal. Special flame-hardening set-ups are easily devised for localized hardening of large or small parts of parts of heavier work.

Mechanical Gas Cutting speeds the shape-cutting of a wide range of steel parts of any commercial thickness. The gauge parts may be sheared in quality with remarkable uniformity and accuracy. Airco makes gas cutting machines in sizes for every requirement.



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Electronics at Work

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A **HARD** Metal
Lining!



Tapered threads in light metal and plastic assemblies are relatively soft, low in tensile strength.



Heli-Coil's Layer Thread Inserts are hard, wear resistant, will not strip, seize or gall.



Engineered in plastic-lined hole, lined with Heli-Coil insert, has strength of hard metal thread, without marring light metal.



With Heli-Coil insert installed, hard metal holding soft metal, each original soft thread is now as strong as steel.

It takes only a few simple operations to line light metal or plastic tapered holes with Heli-Coil Screw Thread inserts. But it pays off in increased assembly service life!

Heli-Coil inserts are helical coils of stainless steel or phosphor bronze wire, precision-formed to agree with American National thread specifications. They have an important edge on solid linings in weight, space and assembly time.

At present, Heli-Coil inserts are solving many tapered thread problems for aircraft production and maintenance men. It's a better than even chance they'll help you, too! Let us hear from you.



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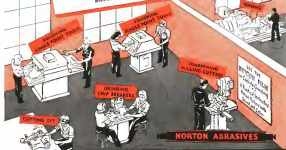
Three Types of Diamond Grinding Wheels plus Crystolon Vitrified Wheels

WHEN the Norton abrasive engineer makes a survey of your carbide tool grinding room he can supply just the wheels you need for every grinder. He has three types of diamond wheels to select from—the Norton Resinoid Bonded, the Metal Bonded and sensational new Norton Vitrified Bonded. Each type has its rightful place—is best for certain grinding jobs.

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Yes, Norton has complete service for carbide grinding.

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Four sit in comfort in the astronomically adjusted seats of the windowed and soundproofed cabin. There's full stability in all directions for pilot and passengers.



You don't have to "prop" and "grub" to get in and out of the Voyager 125. Take a look, too, at the extremely wide doors and unobstructed arrangement, and powered seats.



Fully adjustable seats bring all commands within easy reach. Instruments are all grouped in the panel for quick reading and there is provision, too, for blind-flight instruments. There are wing doors to prevent spins and stalls giving the plane unusual stability and control.

First—FOR TOMORROW'S PERSONAL FLYING!

WHEN YOU take to the air in your Stinson Voyager 125, you'll really feel up and down!

This new personal plane by Stinson is a cross-country ship that will take four people. And there's plenty of room for luggage besides.

Take a look at these close-ups of the Voyager 125 and see what comfort, safety, and economy are in store for you when you fly your new Stinson.

And that door isn't too far off. For, although we're still busy building planes for our fighting forces, the Stinson Voyager 125 will soon be coming off the production line in quantity.

In the meantime, we'd like to send you a booklet giving full information about the Voyager 125.

For FREE illustrated brochure, write Private Sales Director, Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Mich.

PERFORMANCE OF THE VOYAGER 125

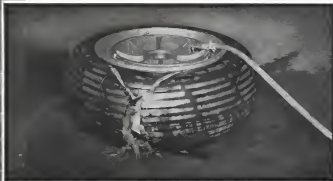
Maximum speed 155 mph
Cruising speed 114 mph
Maximum endurance 5 hours
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Operating costs are low! You'll fly the Voyager 125 for less than 6 cents a mile... approximately 10¢ more per hour per mile. That includes everything... maintenance, complete insurance coverage, hangar storage, gas, oil, and reserves for overhaul.

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FREE SERVICE MANUAL: A new and complete Service Manual for owners of the Stinson Model 30-A (Voyager 90) is now ready. Send 10¢ and actual members of your Voyager 90 for your free copy... to Stinson, Wayne, Mich.



Tire explodes at 635 . . .

Another example of "Building for today, testing for tomorrow"

ONE PHOTOGRAPHER waited hours to take this picture of a tire exploding. At a needle-like stream of water forced into it, the internal pressure went up . . . twice as much as the tire would normally need to take . . . three times . . . five times . . . six times.

Suddenly, at a pressure of 635 pounds, it exploded! The picture our photographers had wanted so previously turned out to be exactly a geyser of water. But the smaller picture shows what happened. The bead and sidewalls, the parts most likely to fail, held until the tremendous pressure tore through the crown of the tire.

Such things shouldn't be done on tires except in one. This one needed an extra safety factor for a special purpose. But pushing tires beyond endurance, and doing it scientifically, is one method of B. F. Goodrich development. We call it testing for tomorrow. Even ordinary passenger car tires are driven at 180 miles an hour, because they may someday have to operate safely at such speeds.

Airplane tires are tested at greatly multiplied pressures, because tomorrow's planes may require it. Nobody knows how flying conditions may change

in the years ahead. But B. F. Goodrich expects to have tires and other aviation products that meet the conditions—no matter what they are!

Looking ahead—testing for tomorrow—enabled B. F. Goodrich to produce the best tire engineered and built especially for airplanes, and today more than 80 rubber and synthetic rubber products for airplanes are manufactured by the company. These include De-Icers for wings and other leading edges, bullet-sealing fuel cells, grommets, cushions for instrument panels and many others.

One complete, fully-illustrated catalog is just off the press. Catalogs list our lines on all types of B. F. Goodrich products for planes. For free copy, write to The B. F. Goodrich Company, Aeronautical Div., Dept. A8, Akron, Ohio.

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The inherent soundness of the NEW BENDIX disc brake design is demonstrated by its ability to meet the braking requirements of all types of planes.

The same principles of construction are applied to brakes ranging from 9 in. to 31 in. in diameter and the same outstanding braking results are obtained regardless of the size or type of plane. In this new Bendix disc brake, heat absorbing elements called rotors turn with the wheel by means of keys fastened to the wheel itself. These rotors are made in sections rather than in a continuous ring which results in far greater capacity for heat absorption, eliminating fading or warping of either rotating or fixed members. Also contributing to all around efficiency is the fact that this new design effects considerable weight reduction in wheel and brake assembly. Thus low hydrostatic displacement and greater heat absorbing capacity combine to produce maximum braking effectiveness.

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One design



gives maximum
braking effectiveness

Design Feature—Fixed discs are held with sliding lining, which is important in such a way as to absorb lining dust and provide air circulation. Slideways bearing and give greater lining life with less wheel pressure.

Bending members, fixed to the wheels, provide large heat-absorbing capacity.

Rotors are made in segments instead of a continuous ring; this allows for heat expansion without warping or cracking.

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FREIGHT RATES and INDUSTRY LOCATION

A SIGNIFICANT decision, announced by the Interstate Commerce Commission last May, will take preliminary effect on the 30th of August. It will eliminate some of the advantage in freight rates which Eastern shippers have enjoyed over shippers of the South and West.

The decision has been enthusiastically hailed as an Emancipation Proclamation for industrial development in the South and West. It has also been roundly condemned as a well-known control measure that ignores valid differences in haulage costs, and recklessly blots out one of the important factors in determining the location of American industry.

Cooler appraisals indicate that the net effect of the rate changes will be far less drastic than predicted by the more passionate advocates or adversaries. Nonetheless, it is important for the business world to be informed both upon the principle at issue, and upon the foreseeable consequences of the ICC ruling.

What The Decision Calls For

The Commission's order, unless modified, or successfully contested in the courts, will require: (1) the eventual establishment of a single freight classification, or grouping of commodities for rate-making purposes, for application throughout the United States; (2) a single level of "class rates"—or rates established for groups of commodities and primarily applying to manufactured and semi-manufactured articles of high value—in the area east of the Rocky Mountains. This level is to be about 15 per cent higher than the present Eastern scale.

Because it will take some time, probably several years, to work out a uniform classification in place of the three major classifications now existing, a preliminary adjustment is provided.

Under this adjustment the existing classifications will remain in effect, but the rates on articles moving on class rates will be increased 10 per cent in Eastern or Official Territory—the area east of Lake Michigan and the Mississippi River and north of the Ohio River. On the other hand, the rates will be reduced 10 per cent on articles moving on class

rates in the South and West, and on those moving interterritorially.

What The Problem Was

At the present time there are marked differences in the levels of the base scales of class rates in the five major rate territories—Eastern or Official, Southern, Western Trunk-Line, Southwestern, and Mountain-Pacific. It is difficult to average the levels of rates, but if the level of the class-rate scale in Official Territory is taken as 100, the levels in the other territories may be roughly considered as follows: Southern, 130; Western Trunk-Line, 125, 140, 161, 184 in Zones I, II, III, and IV, respectively; Southwestern, 161; Mountain-Pacific, 184.

These are over-all comparisons. On many individual articles the differences in levels of rates are greater or less than indicated because of offsetting differences in regional classification schemes. In many cases, the use of exceptions to the classifications and of special commodity rates has reduced the regional disparity in rates. In fact, on some articles, particularly on certain low-grade traffic such as logs, plywood, bricks, coal, and gravel, the South and the West have actually had lower rates than Official Territory. The rate disadvantage of the South and West has been principally on manufactured articles.

The territorial differences in class-rate levels have complicated the problem of constructing rates from a point in one territory to a point in another. Today, such a rate tends to represent a blend of the levels in effect at the place of shipment and at the destination. Thus manufacturers and dealers in a higher-rated territory are likely to see themselves at a disadvantage when they attempt to sell goods in a lower-rated territory against competition located there.

Now, if differences between territorial rate levels are removed, the interterritorial freight-rate problem largely disappears. So it is an important question whether such differences are justified. The Commission has found that they are not justified either by differences in transportation costs or by

other valid considerations. From that finding came the order to establish a uniform level of class rates and a single freight classification.

The Decision And The Map Of Industry

What effect will this decision have on the location of industry in the United States; and what effect will it have on the economic development of the East, the South, and the West?

Today, many in the West and South believe that their higher class rates have seriously retarded the industrial development of these areas, and promoted the concentration of manufacturing in Official Territory. They point out that Official Territory has over 50 per cent of the population of the country, had nearly 70 per cent of the persons employed in manufacturing in 1945, and accounted for nearly 73 per cent of the "value added by manufacture" in 1939. Boasts of industrial development in the South, and to some extent in the West, in recent years are accompanied by claims that this would have been greater but for the freight rate structure.

Another point gets into the argument. Official Territory is not only the country's most highly industrialized section, but also its greatest consuming territory. It is the market which nearly all manufacturers desire to reach, particularly when they have a surplus to sell. Here again is occasion for an outcry by producers outside of Official Territory against the consequences of their high rate levels and the levels of interterritorial rates. Under the circumstances it is not strange that the South and West have argued long and valuably for mile-for-mile equality in rates.

Those in Official Territory deny that the South and West have been handicapped by the rate adjustment, but at the same time look with apprehension at the loss of their rate advantage.

What's The Effect?

However, now that the ICA's ruling is about to be put in operation, it is time for the colorless statesmen of the debating period to give way to a sober appraisal of what the consequences are likely to be.

In the first place, it should be noted that the preliminary adjustment will affect only a small fraction of the traffic. Estimates indicate that only about 4 per cent of the full-carload traffic moves on regular class rates. About 11 per cent moves on exception ratings which are not affected by the preliminary order; and about 85 per cent moves on commodity rates, which were not within the scope of the Commission's decision. The proportion of less-than-carload lot traffic affected is much greater, since a large

part of it moves on class rates; however, less-than-carload traffic constitutes less than 14 per cent of the total tonne carried.

The permanent rate structure will probably affect more traffic than the preliminary order does, in the establishment of a uniform classification containing more classes than at present provided, many articles now moving on exception ratings are likely to be brought within the scope of the classification, and the same may be true of some articles moving on commodity rates.

But, even if a large proportion of the traffic were affected by the Commission's order, or if the principle of equality in rate levels is eventually extended to much of the traffic moving on commodity rates, these freight-rate adjustments cannot be expected to revolutionize the pattern of industrial location in the United States.

It seems evident that most industries now found in Official Territory are located there for other advantages than that of a lower level of freight rates, undesirable as such an advantage is, insofar as that is the case, they have little to fear from equalization of the rate levels. For those which have, indeed, been dependent upon preferential rates and otherwise badly located, the removal of the preference and their consequent shift to some area possessing a real locational advantage would be desirable from the point of view of the national economy.

While the high degree of industrial concentration in Official Territory does not rest on such a flimsy basis as a lower level of class rates, the Commission's decision does remove one existing handicap to the growth and development of the South and West. The new adjustment should permit all sections of the country to develop the industries for which they have natural advantages. It should contribute to a sounder regional specialization than we have heretofore had.

This decision will neither destroy the economy of the industrial East, nor will it, overnight, assure the industrial flowering of the South and West. Its contribution one sound step toward establishing that equality of opportunity for all sections of the country which is essential to a nation that bears the proud title of The United States.

James H. McQuinn, Jr.

President, McGraw-Hill Publishing Co., Inc.

For PRACTICAL Glory Try Tail Wheels and Folding Wings

BACK IN THE GOOD OLD BASTARDIZING days, when flying was the sport of amateurs and there were not enough airplanes to make it much of a business, the pilots were a rare sport. In fact, the pilot played himself so far apart from ordinary mortals that he felt it unbecoming to do most of the things that most of us do if we are to be successful in business. Such mental tasks as getting business, keeping books, and controlling costs were far below his dignity.

When summer skies were bright and Sunday drivers thronged his airport, prosperity was his and the day's receipts were quickly squandered. But when a few rainy week-ends or the expense of an engine overhaul or a repair job and the only recourse was to go out and try to find a new angel who would be willing to supply a newer airplane.

The lives of these pioneers, who really laid the groundwork for public acceptance of flying, were merry at times and often they were short. One flight too many in an inadequately maintained airplane was the last flight for many of these old gliders who lived as gladiators in the eternal shadow of the sheriff.

WE HAVE COME A LONG way since these days of irresponsibility, but we have not come far enough in the development of sound business methods applied to fixed base operations. Even now many of our operators feel themselves above their costs, and wonder why the tide of real risk is always threatening to engulf them. Only a few have taken time out to sit down and analyze the cost of the many small services the customer expects.

Even fewer have followed such analysis with the necessary steps to trim their costs down to the point where each branch of the service shows a profit. Too many operators are content to take a loss on one item of service, like airplane storage, in the hope that the customer will buy some extra service or some item of equipment which provides the operator with greater profit. And when the customer doesn't play that way.

Hangar rental, for example, is a tough problem for operator and customer alike. An airplane takes up a lot

of space, and an ordinary hangar roof is an expensive structural problem because of the wide door openings. The high cost of storing an airplane is a deterrent to plane ownership as serious that all hands should get to work to cut it down. Designers of personal airplanes could enhance their market by perfecting a pocketable folding wing craft. Such a plane could be stored much more economically than present types. Operators could then reduce rental charges and still break even or make a little profit on storage, which few of them do at present.

A **S**IMPLE thing. Tail wheels are a must for simplicity in ground handling, and remember it costs money to push planes around. One successful operator is considering a higher rental rate for planes equipped with tailwheels—thus to encourage their owners to buy tailwheel wheel equipment to save ground handling costs. The tail wheel is a step in the right direction, but surely an airplane which can be driven around the airport is going to appear and start the less progressive manufacturers scurrying for the licensing rights to the design that makes it possible.

Until we have real taxiability and until prop spinning is as obsolete as the old automobile hand crank we are not going to enter very large segments in the public realm of airplane ownership.

There are but a few of the problems that must be solved by teamwork among operators and manufacturers of airplanes, accessories, and equipment. We have passed the stage when designers' efforts could merely be concentrated on developing an airplane that would succeed in getting off the ground and staying in the air for a reasonable length of time. Now we must turn our attention to the seemingly secondary details and refinements that will make plane owning easier and more economical.

Leslie E. Zwick
EDITOR

Nature Deals a Trump To Marine Airport Designers*

—Since the runways are already provided, that engineering of the flying boat port is simplified and fundamental economies are indicated. Here the author considers the building, decking, and patrol requirements, presents three schemes for seadrome layout, and gives detailed specifications for cable-connected tide markers.



By CAPT. C. H. SCHILSHAUER, USMC

JUST AS ARCHITECTS are proffered timing to support world-route use of landplanes, so, too, many very logical reasons can be put forward favoring broad employment of flying boats and flying ships in global air transport.

Granted, there are specific reasons which are inherently favorable to one type or the other. One contention is that the flying boat offers better scope for the development of the very large aircraft.

* Opinions and recommendations in this article are those of the author and should not be construed as official views of the Staff, Department.

At the same time, the flying boat gains both in aerodynamic and structural weight efficiency, more than does the landplane. Any substantial increase in size and weight of the landplane introduces great difficulties in the provision of satisfactory landing surfaces as well as difficulties pertaining to the landing gear on the plane itself, not to say with the flying ship.

Any map of world air networks will quickly illustrate how the globe abounds with areas which will make seasonal operation of flying ships.

The future appears not for any large aircraft, landplane or flying ship,

thrust or wing shape, designed for daylight operation, requires mainly a mooring or anchorage tractor to handle passengers and cargo both on land and water and a terminal building addition. Indeed, mooring may be omitted if flying boat commander chooses to employ ship's anchor.



may be 300,000 lb, however, the practical limit in handling frequency in world commerce may be approximately 250,000 lb. Studies indicate that an optimum flying ship of 500,000 lb would require a channel 28 mi long, 800 ft wide, and 12 ft deep. With such a channel, this flying ship will clear a 38-ft obstacle at the end of the island area, even should one require lift during this critical period. With no mooring island, the 500,000-lb flying ship would require a channel approximately one-half of the above length.

In the realm of the immediate future where flying ships of 300,000 lb will



Major changes, such as those in case shown, require more extensive facilities, as depicted here. Yet safety still need not be sacrificed. Seen are shore-connected "U" docks with wind-operated mooring lines, and beyond a small covered dock for seadrome patrol boats.

"U" dock can be moved for use in supplying area when shore connection is not practicable. Seadrome dock could be constructed with arrangement to draw water out of "U" ship with compressed air to enable work on ship's deck.

make their appearance, channels approximately 2 mi long, 800 ft wide, and with a depth of 10 ft are considered ample.

Such water areas require no more surrounding protection than that found anywhere in the Chesapeake or San Francisco Bay areas, where flying boats both small and large have been operating since the initial days of aviation.

A distinct advantage of the land airport would be its location adjacent a seadrome. It will be required that international traffic carried by the large flying ship be distributed to a number of locations by short-haul land aircraft. Conversely, short-haul land aircraft are the leaders of the international flying ship services.

Typical seadromes in actual operation in international air commerce are exemplified by Mills Field at San Francisco (charted in our page 113 chart insert) and John Rodgers Airport at Honolulu. Others under consideration are Idlewild at New York City, and Shannon Airport near Limerick, Eire.

England is considering the warlike oil Collett, on the river just south of Southampton, as a flying ship operating area, with full terminal facilities projected. And an adjoining land airport, on the lower east bank of the mouth of the river, would provide for operation

of landplane shuttle services to other throughout the British Isles.

France, in former days, being cognizant of the possibilities of the large flying ship in international air commerce, planned for a system of channels in the lowlands in the vicinity of Paris. The project called for supplying these channels with water from the river Seine. It is also noted that prior to the war Lake Beauport, in the vicinity of Bordeaux, was actually used for commercial flying boat operation. Greece, Switzerland, would also afford ideal year-round seadrome facilities for large flying ships. And it may be pointed out that the British have been operating flying boats, with extensive ground connections, from England to Australia and New Zealand.

Thus, throughout the world natural water areas are potential operating areas for seadrome aircraft.

Seadrome Layouts

It is specified that seadrome runways be marked for degree use by distinctive lights and for night use by distinctive lights, and it is considered the most practical idea to combine the two systems in one. Control of the night lighting system is via a master switch from the adjoining land airport, and thus the most favorable manner, in regards operating conditions, can be

achieved. The designation of runways may be similar to that in the operation of landplanes—with reference, in number, using the respective compass points to line of approach.

Various schemes of seadrome runway layout are shown (Fig. 1, next page) and many markers for day and night use of seadrome runways are depicted in Fig. 2. Regarding these markers, it is to be noted that where the operating water is of such depth that the lights and the indicator's markers can be moored on piles, there can be considerable saving in installation costs, and maintenance can thus be facilitated. Such a system is illustrated in Fig. 3.

Patrol by Tugboat

Each seadrome should be equipped with an adequate patrol and control tower, location being to patrol the seadrome and to advise the aircraft by radio (either directly or via the control tower) of the operating conditions in the landing lanes.

Anticipating the operation of flying ships of 150,000 to 200,000 lb in the immediate future, the suggestion is for a seadrome tender approximately 42 ft long, with a 12-ft beam, 10-in screw, twin rudders, and rudder beam for easy maneuvering in the vicinity of flying ships. It is essential that the

FIGURE 1-THREE SEADRONE LAYOUT SCHEMES (With Cable Connected Lane Lighting)

The diagram illustrates three layout schemes for a Seadrone system, showing the arrangement of buoys, lights, and cables. The schemes are labeled A, B, and C. Scheme A shows a central buoy connected to three other buoys. Scheme B shows a central buoy connected to two other buoys. Scheme C shows a central buoy connected to one other buoy. The diagram includes a legend for the symbols used: a solid line for Buoy, a dashed line for Lane light, a solid line with a cross for Obstruction light, a solid line with a circle for Buoy light, and a solid line with a triangle for Buoy light (obstruction light).

This vessel should have a maximum speed between 25 and 30 mph, yet must also be able to run for long periods on slow-speed outboard propulsion. A strong towing post should be provided approximately midwater in the stern from the structure of the transom. Strong fishing gear should be made feasible by provision of a high-point long-range stern of either waler or beam from waler outrigger on the bow, as well as bow-line trawls hauled from the stern.

The tender's entire fire fighting equipment should be powered by a separate motor. Provisions should also be made for attachment of a suction line to enable pumping of water from partly flooded living boats or floating docks.

The second member should, moreover, be equipped with the characteristic retaking identification light—orange, amber—and also a high power 18-in. searchlight. For communication with aircraft and with control tower, a radio telephone sending and receiving set is required, well protected from sparks and moisture in the sheltered cabin. Another "must" would be windshield wipers for operation in rain; wipers. Equipment for handling and hoisting mooring and bows can be installed aft.

Flying ship operations can take advantage of the world's natural water facilities. The many lakes and rivers and harbors of North America, South America, Europe, Africa, Asia and Australia are all potential operating areas. These waters can support the smallest of flying-boat yachts or the largest of flying ships without additional expenditures—quite in contrast to the requirements for the operation of the larger tankships.

The simplest terminal may consist of merely (1) a mooring placed in position prior to the landing (which may be casted in event the flying boat employs its anchor), (2) the terminal building ashore, and (3) an amphibious tractor to handle passengers or cargo both on land and afloat. Such a base provides adequate facilities in construction, services.

The diagram illustrates two methods of mounting seadrome marker lights on buoys. On the left, a single buoy is shown with a 'Retriever buoy' and an 'Anchor' connected by a 'Submarine cable'. The buoy is marked with '100' and '100' degrees. A 'Light buoy' is shown with a '100' buoy' and a '100' buoy' connected by a '100' buoy' cable. The buoy is marked with '100' and '100' degrees. On the right, a double buoy system is shown with two 'Retriever buoy' and 'Anchor' connected by a 'Submarine cable'. The buoys are marked with '100' and '100' degrees. A 'Light buoy' is shown with a '100' buoy' and a '100' buoy' connected by a '100' buoy' cable. The buoy is marked with '100' and '100' degrees. The diagram also shows a '100' buoy' and a '100' buoy' connected by a '100' buoy' cable. The buoy is marked with '100' and '100' degrees.

[illegible]

The flying ship fitted with reversible propellers is readily maneuvered to pitch up or down, moving fast, or, when the ship is heeled for the other tail first or bow first, with the aid of power-operated winches on the deck.

The shear-connected U-boat permits access to the craft from both sides. It further permits the operation of heavy cargo and mail trailers directly to the side of the aircraft for loading and unloading.

Aircraft access stands of a periscope type are stored in the stern end of the dock. The stand can be hoisted overhead so that in rainy weather the windward and leeward are protected.

Cooking is done hot hot water

solid weather, can be moved about the deck and connected to the various compartments to keep them at a comfortable temperature prior to takeoff.

In locations where a shore-connected dock is not practicable, the entire "U"-dock can be mounted out in the operating area. Under these conditions, power and light as well as compressed air can be supplied by portable units mounted on, or in, the various floating units of the dock. In such cases, the cargo would be handled by boat and can be made available on the dock prior to arrival, as well as taken ashore after departure.

FIG. 3.—FIVE-ARMED STARFISH.

[illegible]

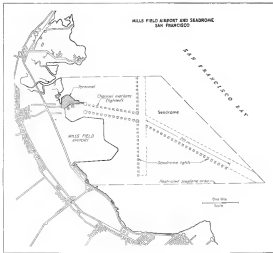


San Francisco patrol boats, such as the one shown by author, carry a 42 ft. motor and two 12-ft. boats. After dredging makes 10 ft. of water, the tugboat is out of all-weather water. After the tugboat is out of all-weather water, the tugboat is out of all-weather water. (Photo by Owen Taylor Co., Baltimore, Md.)

low the open "U," with scum to fit the hull shape and an attachment for compressed air. When the water is blown out, the entire section will rise and the flying ship will be lifted clear of the water for full work.

Shelters of the canvas type can be constructed so that they will protect mechanics working on the engines, in those places where major engine work or engine changes are required.

We may conclude that it will be through the production of volume traffic that air transportation will be placed on an unshakable business basis. And it is held that such traffic will be available when fares and cargo and cargo charges are brought within the reach of greater numbers of people. The flying ship of adequate size, seasonally operated from natural water areas, may well be the solution in making broad-world use of fast, medium air transport.



An AVIATION correspondent aboard one of the Navy's newest jet-fighters follows the rugged, highly skilled Service Unit in action, and finds that—

It's No Child's Play Arming and Fueling Carrier Planes

By BLAINE STUBBLEFIELD, Washington Editor, "Aviation"

AMONG THE U. S. S. BOMBERMAN, BOMBARDIER, and other heavy aircraft carrier's Service Unit has one of the toughest jobs aboard ship, for it is charged with those major tasks which call for plenty of skill, strength, and courage.

First, the Service Unit must service and load all airborne guns, second, it loads bombs, torpedoes, and incendiaries; and third, it fills all aircraft gasoline tanks and operates and maintains the ship's extensive gasoline system.

Since all the costly resources used in building and operating this—and every other—carrier are aimed at bringing an airborne armament to bear on the enemy, the Service Unit must argue with full conviction that their job is one of the most important aboard.

Personnel of the Bomberman Pacific are organized in two groups: The Ship's Company, which operates the carrier, and the Air Department. The latter has five sections: V-1, Flight; V-2, Maintenance; V-3, Operations; V-4, Administration; and V-5, Air group, which includes the airplane crew.

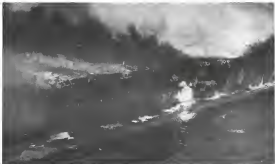
The Service Unit is a part of V-1, and it has two branches, Ordnance and Gasoline.

Ordnance men must be specialists in more than one type of armament, for between the lighters, dive bombers, and torpedo bombers, three types of guns are used: 20-cal. 38 cal., and 30-cal. In action an ordnance man of the Service Unit rushes to meet such incoming plane, opens the wing cover, cuts the gun switcher and controls, and immediately pulls out the bits of unexpended ammunition. It is a hairy business quickly taken, for potential accidents lurk on every hand aboard a carrier, and they could easily result from airborne guns not disarmed.

One of the principal every-day jobs is to disarm ordnance in clearing and stowing, because the continuous attack of



Ordnance men of a carrier's Service Unit must be specialists in more than one type of armament. Lighters, dive and torpedo bombers, three types of guns and incendiaries are used. (Photo by Owen Taylor Co., Baltimore, Md.)



Carter Service Unit men explain that their duties are as important as any other—the planes without fuel and weapons don't fly. And their work, they maintain, is no less dangerous than any one else's, for they deal with all types of ammunition hazards.

sult water on both planes and guns is plentiful. Though an every-day task, cleaning and oiling is always a potential job. Moreover, grips of such difficulty are used in checking gun bores that they run indicate approximately how many rounds have been fired from any given barrel.

Speed sets are used for different guns, and different oils for high and low altitude operations. Cleaning and oiling must be done daily, whether the guns are fired or not, because effectiveness of a mission and the lives of men—men depend on that task. All fuel guns have to be harnessed with the sights and the longitudinal axis of the planes to assure convergence at the desired point. This point of convergence is changed for different types of training and combat; but even if no change is made, the alignment of the three elements must be checked. This, it is obvious, is work for experts.

Whereas early airborne machines guns had a high rate of jamming or other failures, such stoppages have proved unusual in this war. Nowadays when a gun goes in it rarely stops; due to a lucky shell, but the hydraulic charges automatically clear it and the gun goes on shooting. Experienced pilots, like machine gunners, can spot largest gun and report which they are in ordnance crew.

In addition to guns, all three types of

planes carry bombs of various kinds—general purpose, incendiaries, armor piercing, fragmentation, or depth charges. Only the Grumman Avengers carry torpedoes. Since the bombs carry different fuses for different purposes, the ordnance man must be experts in time setting, and they must know the varied suspension fittings on the planes.

Bombs and rockets must be handled with a feather touch, whether the gun is fired or not, because effectiveness on this field is important, because scores and sometimes hundreds of men are directly under and around any given location on the flight deck.

Ammunition, bombs, incendiaries, and rockets are kept in heavily armed magazines below decks. When wanted they are brought part way up on one elevator and then transferred to another. Reason for this arrangement is that there must be no vertical opening directly from inside one deck down into the ship through which the enemy might make a lucky drop hit.

Bombs are assembled at the transfer station on the way up. This assembly consists of insulating the tail vane and those which are stored at the station. Getting the bombs up to the flight deck is done, hand, steady work—work in which there must be no mistakes and no delay.

Ammunition—called ammo by the

crews—is not so tame or dangerous as bombs, and consequently is not stored on the lower. There is always enough within easy reach to meet any need. Storing ammo being handled aboard while the carrier is still at dock would make one think the carrier had been ordered for a supply ship.

Aerial torpedoes, comparable to the armament employed by submarines, are brought to the flight deck on the airplane elevators. These "submarine torpedoes" like the carrier type, have a range of several thousand yards and a speed somewhere near that of the fastest surface vessels. Driven by a combination of compressed air and steam generated by burning fuel within a turbine which drives a propeller through a reduction gear, torpedoes are accurate and expensive, accordingly require their own specialists among the Service Unit.

Just beyond limits of the part, on the way out to combat zone, the *Benham* (Richards) dropped anchor and a huge huge view alongside to start pumping gasoline aboard. The port authority, explained the officer in charge, would not permit loading inside the harbor—too dangerous.

That word dangerous is the key throughout any discussion of gasoline and its storage and use aboard this carrier and all others. Besides being

at risk, as well as gasoline, there's what happens when it comes down get through—the U.S. Navy, with living gas—this includes over half the ship's fuel—by day five loaded within 40 m. of the harbor.

a mobile airport, an enormous hospital the home of two or three thousand men and the place of business for dozens of professions and trades. This ship is also a formidable air tanker. It carries a tankload of fuel for planes far as four hours' flying distance and can, when necessary, fuel destroyers as other ships. This is in addition to the gasoline required for normal 2,000-hp. aircraft engines which must not only have enough for long flights, but thousands of gallons for cranking the ship in island and landing order.

Gasoline causes far more devastation and death on aircraft carriers than the enemy does directly with its guns and bombs. From information unofficially given, the writer believes that gasoline fire has caused most of the Navy's carrier losses up to now. Some of these losses have been partly due to lack of experience in the control of gasoline fire, and partly due to fear that gasoline fire is uncontrollable, although, of course, nearly all of the serious fires are set by enemy action.

But these fears have not been in vain. For the Navy's learning many things about gasoline fire. It can be controlled with various gases and chemicals, it can be handled from running and spreading; it can be forced to burn in several small fires instead of one big fire. Most important, in many cases it can be controlled so quickly that it cannot get out of control, except where large quantities are involved. Most important of all, gasoline cannot burn unless it mixes with air.

That is the key to the ship's gasoline system. All containers are always completely full of liquid gasoline and filler head, and all piping is always completely full of the liquid gasoline, or completely empty of liquid gasoline, and vapor and filled with carbon dioxide.

The gasoline tanks, far below decks heavily bulkheaded and armored, are always completely full. As gasoline is withdrawn from outlets at the top, a filler head is pumped in at the bottom.

The level of the filler head rises as gasoline is used. Pressure is exerted on the gasoline (to drive it up into the dispensing system) by the filler head pumps. With use of the filler there is never any air in the tanks to support combustion.



There are many gasoline service outlets on the flight deck, because when the deck is full of airplanes they must be refueled in the fuel. It would be extremely dangerous to use long hoses.

There are fewer fuel outlets on the largest deck. Leads to these outlets require special piping, comprising a system which is quite elaborate, judging by the study in the gas officer's office.

The pipe system is a serious task, simply because there is so much of it in so many places. It can be broken or ruptured by accidents and by direct hit from the enemy or by the consequences of explosion. After escaping had a special, closing of the valves in its field view.

The answer to that problem is to break the piping system down into independent systems; to use only as much of the system as is necessary, and to keep gasoline out of all piping except when fuel is actually being drawn.

This is done by cutting off the pressure, and letting all the gasoline flow back into the tanks. Then of course the piping is full of gas—vapor, which is quickly blown out with carbon dioxide gas. When all gasoline vapor is down and the system is full of CO₂, the valves are closed and the

CO₂ is brought up to pressure. Then you couldn't get the piping after with a blow torch.

The engine device is produced mainly by running the exhaust of a steam-powered gasoline engine through a filter that takes out everything but CO₂. The engine producing the gas serves as its own pressure pump—all in all a very neat trick. Carbon dioxide is handled if involved in quantity, hence it has to be handled carefully.

The Service Unit is responsible for the functioning and maintenance of the gasoline system, which is no small job. Its duty ends where the gasoline hose begins. Then the crew at each particular engine takes over. The idea is to narrow the responsibility down to the lowest number—one man, the crew chief. If anything goes wrong, "he is it." The chief holds the nozzle, a second man holds a potent fire extinguisher, and a third is armed with an extinguishers gun, with which he quickly taps up any spilled gas.

Suddenly, airplane service about is a hard job. As an aid, the carrier boys have to work before the others man start, and they also have to work after the others have quit. And when the planes don't fly, there is the gasoline system to be maintained, and there are also all these hundreds of gates to be closed, and inspected, and oiled.



Timken Bearings Equip New A. A. F. HELICOPTER

PHOTO BY COURTESY HELICOPTER MANUFACTURER.

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DESIGN ANALYSIS OF THE

FAIRCHILD C-82 PACKET

PART I

By IRVING STONE, Assistant Editor, "Aviation"

Beginning a comprehensive two-part study of Fairchild's war-born long-range aerial freighter—a fast plane designed around extensive cargo space and affording immediate practical utility for post-war hauling. . . . The 34th analysis in AVIATION'S load series.

WHEN the rear cargo doors of the Fairchild C-82 Packet swing open, it is impossible to keep one's thoughts on the plane's technical aspects—the almost unbelievable space visible commands all attention. For what is seen is a substantially rectangular 2,870-sq. ft. area, scarcely larger than some rail boxcars. Also, by providing for anti-landing, the device eliminates the 90-day turn involved in side loading, and thus accommodates longer cargo with facility.

It is not alone space which makes the plane unique, for its maximum payload is 18,000 lb. for 300 mi., 15,500 lb. for 1,000 mi. and 13,000 lb. for 1,200 mi. Takeoff runs at sea level, with gross weight of 42,000 lb., is only 800 ft. Cruising speed is over 200 mph at 10,000 ft., and range is 4,000 mi. Three considerations underlie the Packet design: (1) Carrying heavy bulky loads without disassembling them

(2) transportation of paratroopers, and means for rapid conversion of the craft to hospital use, and (3) towing of gliders.

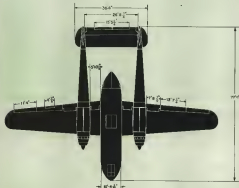
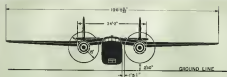
Units to be transported were considered to fall into three categories: (1) Those which could be loaded under their own power—trucks, tanks, half-tracks, and armored cars; (2) those loaded by power of their own power movers—cannons, cannons, trailers, field-kitchens, and other miscellaneous cargo; and (3) those units normally carried in containers of various shapes

and sizes—advantageously handled when loaded directly from a truck to the Packet's truck-bed-level cargo floor.

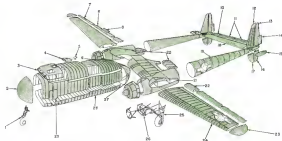
The large rear doors accommodate these types of cargo, and because of the high wing and twin booms and high tail arrangement, can be approached from the rear and sides of the plane, without obstruction.

Since cargo to be transported is predominantly square, sides and top of the cargo compartment are straight for full length to obtain optimum





Substrate of Polymerized C-42 Resin shows good surface and life support

[illegible]

Use of tricycle landing gear places the cargo floor horizontal for its full length.

Loading is facilitated by two ramps adjustable to the trend of equipment being loaded, and brought together at the center, they form a single ramp, unit suitable for loading 500 or less vehicles.

As a soap carrier, the Packard affords simultaneous access for two lines of paratroopers, and coupled with its low controllable speed, permits more than twice the usual concentration of aerial troops in a given ground area.

In the water of the cargo float, a dock boy permits the dropping of straw delivery containers carried on rails with electrically operated shackles releasable by radio or remote control.

Straight walls of the cargo compartment simplify mounting of supports for litters five feet high, with sufficient space in the stater portion of the berths for movement of medical personnel and equipment.

Material of construction in the Packco is generally 24ST Alclad except for higher strength alloy in various highly stressed members.

Business Media Media Trustee

The Packet freighter—54 ft long and approximately 10 ft. wide and 3 ft. high—is of semi-monocoque construction and consists, generally, of main and secondary frames, structure

beams, and deck. To facilitate construction, the fuselage has been riveted into six major sections—main body, sides, upper front, upper rear, nose compartment, and rear cargo-deck compartment.

Main body section—foundation of the fastage—supports the cargo floor. It is composed of frames, stringers, and longitudinal and transverse floor beams.

Fundamental Design Information	
Overall length (mm)	22.5 ± 1.0
Height (mm)	10.0 ± 0.5
Weight	1.00 ± 0.05 g
Weight loss (loss allowed)	0.005 ± 0.001 g
Length of stem (mm)	12.5 ± 0.5
Length of tip (mm)	10.0 ± 0.5
Maximum force (mm)	1.0 ± 0.1

Responsible Editor:

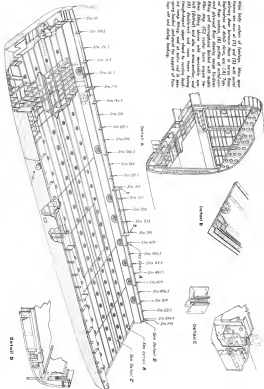
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* *Note.* All weight and performance figures based on the results of preliminary flight tests conducted with full engine overboost. (See figure 10 for details on weight and performance for propeller operation and engine bleed-off.) (See Appendix 1 for details.)

and is approximately 43 ft long from point of nose attachment to cargo door hinge point. From bottom of floor to bottom contour of waven is thickness from 9 in. at its ends to 20 in. at the center. Main frames—except the main spar frames—are spaced approximately 35 in. apart. Main spar frames are so designated because they fall directly below the wing center line stiffeners, and are spaced 32 in. apart.

Main frames of the main body section are U-shaped web beams with straight upper chord members and vertical chord stiffeners. Lower chord members are hydroplastic castings—C-sections. Web gages vary from 035 to 040—the lower being at the main gear frames. Upper chord members vary from 032 to 064, and stiffeners are rolled angle sections with gage varying in accordance with thickness of web.

The main frame has a double row of box construction. Upper chord is trough-shaped, 872 thick, and designed to receive upper stringer or loading straps. Web members are 352 and are reinforced by vertical channel stiffeners. Lower chords are 864 formed angles so which a plate is riveted to complete the bent section. At outer ends of the frame, rail and board of the standard bogiebrake beams, end strings are provided to receive spring-loaded jack-pins to afford support for all end of the base bar while it is being loaded.



This body section of fuselage shows upper and lower chord members, floor beams, side sills, and other structural members. The upper and lower chord members are of 12 in. x 12 in. x 1/4 in. angle. The floor beams are of 12 in. x 12 in. x 1/4 in. angle. The side sills are of 12 in. x 12 in. x 1/4 in. angle. The other structural members are of 12 in. x 12 in. x 1/4 in. angle. The upper and lower chord members are of 12 in. x 12 in. x 1/4 in. angle. The floor beams are of 12 in. x 12 in. x 1/4 in. angle. The side sills are of 12 in. x 12 in. x 1/4 in. angle. The other structural members are of 12 in. x 12 in. x 1/4 in. angle.



Four of main body section looking aft, showing longitudinal beams and frames: (1) Dullwood beam, (2) side beam, (3) intermediate beam, (4) center beam, (5) main beam, (6) web stiffener, (7) chord for tying in transverse beam section, and (8) axial vertical stiffener opening with center beam removed.

Accessory frames are constant depth C-sections varying from 625 to 632, with the heavier gage between spar frames, and are located between main frames to reduce the length of skin panels to approximately 17 in.

Main body section has 7 longitudinal floor beams, two endwood, two intermediate, and one at the center. Dullwood beam, 58 in. apart, are located above the floor, the beam on the right side running the full length of the cargo compartment, and rest on the left extending from the rear cargo door frame to the front entrance door frame where it runs forward below the floor. The beams are of web construction of constant height, with rolled angle upper and lower chord members and tapered channel-section vertical web stiffeners. At typical section beams are 15 in. deep with 630 webs and 631 chord members. The vertical stiffeners are extended beyond the lower chord member to provide anchorage for the outer ends of the transverse floor beams. Lower chord runs on and is riveted to even floor upper chord members and the web of the outer beam is riveted to the vertical stiffener which forms the reinforced edge of the U-shaped main frame. Web of each beam has notches for attachment of rigid ventilation. At vent-later cutouts, the web is increased to 636, and an additional drop-battened section is used to stiffen the beam. Sideboard beams, fabricated in lengths to fit between side frames, are located below the floor and spaced approximately 58 in. apart. They have web construction with rolled angle upper and lower chord members and vertical web stiffeners. Typical section has 640 web, 640 upper caps, and 641 lower caps. The webs are riveted to the vertical web stiffeners of main frames. Chord members on either side of main frames are made continuous by joining with a splice plate which passes through an opening in the main frame web. Lower chord of the sideboard beam follows the contour of

the main body section, is applied for continuity, and passes through notches in the lower chords of main and auxiliary frames.

Intermediate beams—also located below the floor—are made up in sections to fit between main frames and are spaced 20 in. apart. They are web beams, with upper and lower chord members spliced for continuity, and have vertical web stiffeners. The beams have a constant depth of 16 in. and do not extend to the center. Typical section has a 632 web and 631 upper and lower caps.

Center beams are similar in construction to the intermediate beams but instead of a single web, has two webs spaced by chord stiffeners. The beam is designed to take loads imposed on it by the apron angles hold-down fittings used for bolting power plants mounted on cradles or to resolve eye bolts for latching other heavy cargo.



Portion of main body section main beam: (1) with (2) upper cap, (3) lower cap, (4) splice plate, (5 and 6) angles for web attachment of intermediate beam and subfloor beam, respectively, (7) upper and lower cutouts for subfloor beam caps (4) stronger web, and (5) attachment of intermediate subfloor to main body (6) web

Hold-down fittings are cast, have a center boss and two flanges, and are designed to sustain a load of 5,000 lb in any direction. The beam is drilled to receive a steel banding tapered for a 4-in. bolt, and the flange provides means of attaching the fitting to the center beam web.

Between main spar frames, the center beam is removable and is equipped with fittings at upper and lower chord members to engage mating fittings on the spar frames. The beam is secured by four bolts and when it is removed, the ribbed beams and main spar frames form a box-opening approximately 52 in wide by 72 in long for dropping aerial delivery containers.

Transverse floor beams are bolted to the center beam, extend to 432 in, and are

spaced 58 in on centers. Used in sections of the cargo floor usually heavily loaded, they extend from the outboard beams to the intermediate beams and are supported in place lengthwise by the subfloor beams.

Cargo floor—designed for heavy loading and to withstand vibration and impact—is constructed of 3-ply Douglas fir plywood core to which is bonded a thin sheet of aluminum alloy on the bottom side and a heavier sheet on top having corrugations spaced 30 in on centers. The corrugations are bonded with angle strips to prevent warping of the metal and prolonging the life of the floor by facilitating the sliding of cargo. Between corrugations the floor is coated with non-slip paint.

To facilitate fabrication and maintenance, the floor is constructed in

removable sections. Over the aerial delivery opening is the fastlane center; the floor consists of two doors, hinged at outer fast-lane-ends, edges to the subfloor beams, designed to withstand the same degree of loading as the floor proper.

Spaced on 30 in centers is the floor in a pattern of hold-down fittings, each provided with ring and stud for lashing cargo, and designed to sustain on vertical a 1,250 lb and side load of 900 lb.

Passage Sides

For ease of fabrication, fuselage sides—consisting of main and auxiliary side frames, longitudinal stringers, and skin—are constructed on separate walls.

Main side frames have flanged bolts and bonded angle, rolled lip edges placed back-to-back to form the inboard chord members, and C-sections outboard chord members fastened to the center of the fastlane.

Side spar frames provide the transition fit to the wing outer section spars and are tapered from a single frame at the lower portion to a box frame at the upper portion to afford a base for the fastlane-to-wing attachment fittings. One of these fittings is mounted on the inboard flanges of the frame, and the other to the outboard flange. Case spars blades are provided between the webs to enable the upper end and form a rigid base for the attachment of the fastlane-to-wing fittings.

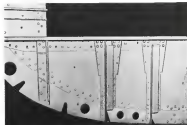
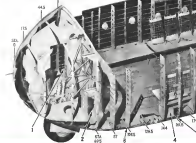
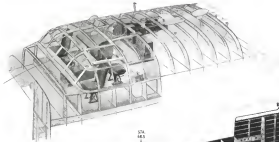
All frames, except spar frames, are machined to permit installation of corrugations called bulk angle stringers.

Twelve 5-in. holes provided in the skin for bulk mounting of crawler windows are reinforced by an angle on the inside.

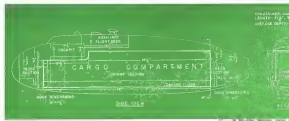
Passage Upper Floor Section

The upper floor section is located between the end of cockpit floor, at station 194B, and the wing center section front spar, at station 309. It consists of a series of arched frames to which horizontal beams are riveted, longitudinal stringers, skin, internal fore-and-aft beams, and a covered corrugated floor for access to the sides.

The arched frames are pressed C-sections with return lip on the inside flange and flanged holes in the web, and at a typical section, main frames are 4½ in deep, auxiliary frames are 3½ in deep, and frame gap is 432 in. The horizontal floor beams are built-up I-beams having 432-in web and a depth of 5 in at typical section. Fore-and-aft internal beams are C-sections with return lip on both upper and lower flanges and flanged holes

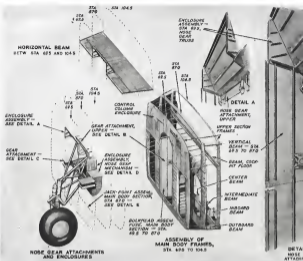
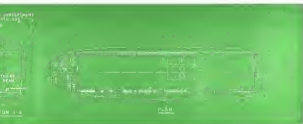
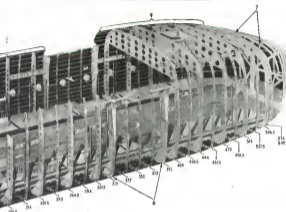


Center of main beam. Flat angles differences are shown at center.

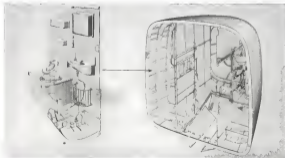


View of Passage during major test.

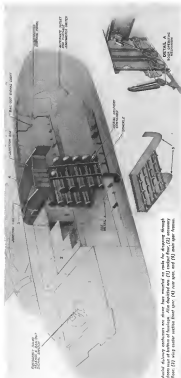
Figures showing general arrangement of fuselage (1) opening to hydraulic equipment compartment in nose section, (2) opening to landing, (3) main frame, (4) main body section outlined frame, (5) auxiliary frame, (6) side spar frame with fuselage-chassis wing at top of fuselage, (7) cargo door, (8) life raft compartment, (9) upper nose section, and (10) upper rear section. View of cockpit section at top left shows control arrangement for pilot, engineer, navigator, and radio operator, and necessary floor for radio equipment as shown at rear.



Fuselage construction for landing



New section compartments: Hydraulic equipment is at right, nose gear doors in center, and landing at left.



As the tip of the bulkhead, on each side of the main fuselage, is a cut-out controlled by a pendulum bearing to provide clearance for pilot's and co-pilot's control columns in extreme forward position.

At the tip of the bulkhead, a combination unit at the lower portion and having a forward frame attached to the top, is also provided with springs on each side. Clearance for the nose gear mechanism mechanism is provided by three smaller openings covered on the aft face by an enclosure consisting of vertical members, struts, and also fitted with an access door to permit inspection (from cargo compartment) of nose gear unit.

The horizontal and vertical beams between bulkheads at stations 09 and 47 are of conventional web, chord, and web stiffener construction. Horizontal beam has an 820 web and is 32 in. wide. Web of the vertical beam is 104 above the nose gear torque shaft flange, and 140 below. Secured between the bulkhead frames, the horizontal beam and vertical beams form a rigid structure to absorb loads imposed by the nose gear and transfer them to forward end of fuselage.

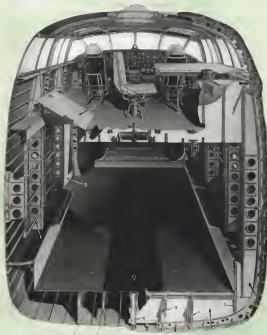
On the inboard side of the vertical beams, struts are mounted to support the nose gear lower area and maintain shaft. Outboard side of the vertical beams are reinforced in the region of the flange by two horizontal beams about 10 in. deep which run between the bulkhead frames.

The nose gear upper truss supporting struts are bolted to an auxiliary box beam formed by adding bulkheads and front and beam sides at the position of the horizontal beam and the aft bulkhead frame at station 47. The box beam also contains the support struts for the upper terminal of the nose gear gravity-drop energy-absorber unit.

At the lower portion of the aft bulkhead and bolted to a vertical chord stiffener, is mounted one of the three major airplane pylons.

The main section extends forward from the bulkhead frame at station 09, and is a conventional semi-monocoque structure having girder, C-section, stringers, and skin. It is divided into three compartments by two vertical bulkheads which run full height from the frame at station 09 to that at station 17-1.

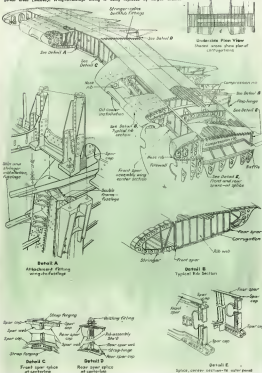
The center compartment houses the nose gear in retracted position and at the bottom are three doors operated by the gear. The two rear doors are



Flow showing flange and control columns. Radial operators' seat, mounted in slotted detail, is located behind pilot's and co-pilot's positions. Forward side seats are being replaced by new rear seats supported by radial leg attaching to floor in-line flange.

Other details are (1) ladder to cockpit, (2) cargo compartment-to-cockpit door, (3) front cargo door, (4) center beam, (5) structural beam, (6) inboard beam, (7) outboard beam, (8) main body section main frame, and (9) main body frame.

Structural details of wing center section. Undercarriage plus view at upper right shows center section more clearly. Wing-to-fuselage fitting is being replaced by larger element



located at the outer edges, and the front door is hinged at the forward edge, and all are constructed of dural skin, with inner skin formed with depressions.

Left compartment is the lavatory equipped with chemical closet, tissue holder, toilet bowl, water tank, linen, towel container, and waste paper rack. A circular window affords lighting and visibility.

Right compartment houses hydraulic equipment, and a crash-resistant panel in the vertical bulkhead provides ready access for inspection and servicing of nose gear. Entrance to left and right compartments is via openings in the bulkhead at station 66. The nose section is attached to the fuselage proper by struts which pass through fittings riveted to stringers and mating with similar fittings on the center fuselage structure.

Cargo Doors

Rear portion of fuselage is constructed in the form of two large clam-shell type doors which swing on a vertical hinge line at fuselage sides, and when fully opened, provide a loading area 8 ft square.

The doors consist of C-shaped frames, struts, skin, and a vertical frame when the C-braces collapse, and are held in closed position by latches located on the center wall near members of the vertical frame.

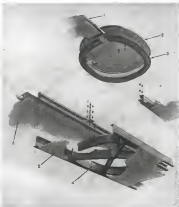
Movement of one door with respect to the other is controlled by one of four door pins. Two pins are located at the bottom of the first C-frame and engage two sockets in the fuselage rear frame; the other two are located in the rear of the right hand door and engage sockets in the left hand door.

In each cargo door, two floor sections are provided—rear floor for rear observation and forward floor for paratrooper jumping station. In the side of each cargo door is a smaller door for paratrooper egress. It is of double sheet construction with inner skin recessed in sections to stiffen the outer skin, is hinged at the rear edge, opens inward, and has provision for locking in closed position and loading in open position.

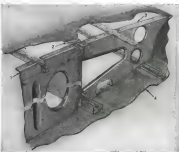
Cockpit Enclosure

Cockpit enclosure, consisting of forward, aft, and side, incorporates a windshield, side windows, and top escape hatches.

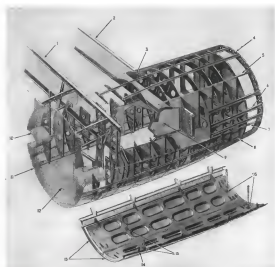
Because of the length of the enclosure span, the sloping W-shaped windshield is divided into four sections. Outer panels located in front of pilot and copilot are non-shatterable double plate glass with space be-



Access door and fuel tank details: (1) Fuel tank, (2) cover for hydrodynamic fuel cell, (3) cover clamping ring, (4) support channels, (5) door skin, and (6) wing skin



Details of landing edge and spar connection: (1) Intake rib, (2) rear spar, (3) landing edge rib, and (4) access panel to flight controls, extending full length of wing



Structural details of nose cone assembly: (1) front spar, (2) rear spar, (3) frames, (4) and (5) fuselage stringers, (6) fuselage stringer, (7) fuselage stringer, (8) fuselage stringer, (9) fuselage stringer, (10) fuselage stringer, (11) fuselage stringer, (12) fuselage stringer, (13) fuselage stringer, (14) fuselage stringer. Details shown are installation.



twice for passage of heated air for anti-icing. Lower windshield are single non-shatterable plate glass. All panels are fast-mounted on the outside.

From the outboard side of each rear windshield panel, a curved Plexiglas transition section extends to

the forward side window and contains a clear-view panel approximately 6 in. square, hinged at the rear edge and opening inward to provide unobstructed vision in event of failure to keep the windshield free of ice.

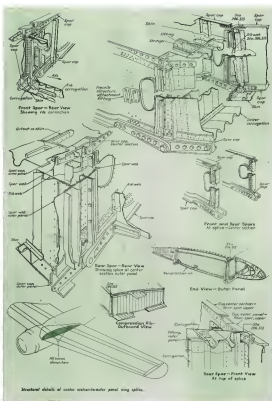
Forward side windows—non-shatterable plate glass—side tilt and head rest is a fixed Plexiglas section the general contours of the crew.

Escape hatches, fitted with doors which can be jettisoned from the crew compartment, are located above pilot's and copilot's seats. Each hatch door consists of a metal frame, Plexiglas panel, quick-release mechanism, and guide wires for sliding a sun shade.

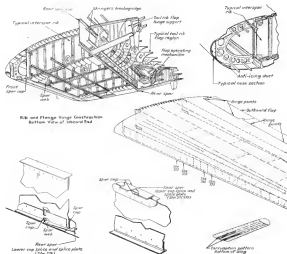
Above wingman's station is an entrance mounted on a square metal frame door releasable from inside and outside to provide an escape hatch for wingman and radio operator.

Wing Center Section

The Pocket has a full cantilever, covered gull, tapered, all-metal wing consisting of a center section and two outer panels which include an internal anti-icing system. The airfoil configuration is based on NACA, sec-



Structural details of center section—rear panel wing spars.



from incorporating without delay.
Should be present, even on stilling.

Camber section, extending to just outboard of the nacelles, is divided into three parts—leading edge, inter-span section, and trailing edge.

Leading edge is constructed of .025 Galvalume painted mild steel, 7-in on center, .025 cross bracing squarewise rolled .025 half angle stringers, and .020 zinc and .020 outer skin covering. The cross bracing is a hot-rolled with flat plate at the base for attachment at web of rib.

Forward portions of the ribs are cut off and flanged for attachment of a sparwire baffle. The baffle, together with inner skin, which runs from the leading edge to 15 percent of chord, forms a D-duct for sparwire flow at leading edge for withstanding gusts.

Aluminum spacer strips fall on ribs
The space thus formed conducts

Inter spar sections are constructed at front and rear parallel spars, intermediate ribs, and top and bottom surfaces. Spars are of conventional web with extruded upper and lower chord members and rolled vertical stiffeners to which ribs are fastened. Front spar is approximately 38 in deep at the centerline and tapers to about 27 in at outer wing panel attachment point inboard of centerline.

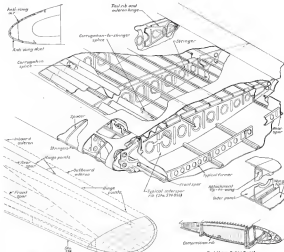
Rear spar is 31 in. deep at centerline and tapers to 22 in. at the outer wing stringer. Spar spacing is 72 in., continuous to the tip splint. At each end of the interwing section, main wing kirgins are bolted to upper and lower chords.

The upper web is continuous at the center of the section, and chord members are joined by bolted extruded splice plates. The web is 345 for 62

Structural details of wing after panel

In each side of centerline, and bearing 52 in. from centerline, thickness increased to 364 out to 174 in. from centerline by adding a lap splice. Thus, between inboard and outboard merge fittings, the spar was in 104 inch. Fastings fittings—145T forged channels with $\frac{1}{2}$ -in.-thick base and $\frac{1}{32}$ -in.-thick outstanding legs—were used from spar to lower spar chord and are spaced to spar webs. These fittings—one at each skin attachment point on front and rear spars—each carry four bolts, and afford a total of 64 bolts to take the full load of the merge. Bolts are $\frac{1}{2}$ in. Fairbairn channels, equivalent to NAS bolts dimensionally and in strength characteristics, but having mechanically

Interapical ribs are .025 web beams spaced 21 in. on centers, and have stiff angle chord members and bat-



In the aciculae are two compression ribs to permit approximately 40% to 50% bending of loading gear. The ribs are double web box beams with 930 webs spaced by 604 channel members, and 372 channel sheet members on the webs are fixed by 604 plate. Fagel and cast fittings are externally mounted on the compression ribs to accommodate anchor pins for the handle and structure and loading gear structure.

Top surface of interspar sections is constructed of sparwise trapezoidal hat-section stiffeners and heavy gage outer skin. Stiffeners are 735T varying from .125 to .248 from front to rear spar, and at centerline are spliced with hat-like stiffeners and tension bolts.

Skin between spans is lap-spliced 24SKT (heat-aged to afford high strength), with gage varying from .182 at front spar to .064 at rear spar. Brazier head rivets are used between spans, and loose front spar forward, running in flush.

Lower surface of interspersed section is made up of standard corrugation and outer side. The surface is divided into two parts—front and rear—with the corrugation extending all from front apart about 24 in. and forward from rear apart about 38 in. Between the corrugations, a stressed skin section door provides means for riveting the assembly and installing fuel cells. The corrugated sections and stressed skin section door extend from the centerline to the nacelle inward compression ribs—342 in.

Posterior spur, near spur, endocrapular rib, compression rib, and top and lower surfaces are riveted together to form the inferior section.

Trailing edge has conventional pinned ribs and stiffened skin. Sips and ribs for supporting the flap hinges are constructed as box beams having pressed webs, rolled sections chord members, and stiffeners between webs. At the ends of these ribs and between the webs, cast flap hinge fixtures are bolted.

Neuville Frame Assembly

When installed, the nacelle frame assembly becomes an integral unit with the center section, and externally, essentially, from aft of the firewall to just beyond the trailing edge of the wing where the forward boom connection is made. It houses the landing gear in retracted position, provides the necessary load-carrying members to transfer the load back to the wing, and consists primarily of stressed skin, skin formers or frames, longitudinal hat-sections, and six "ribs."



Outer panel leading edge: (1) Main rib, (2) compression spars, (3) inner skin, (4) half angle stringer, (5) lower spar upper chord, (6) spar web, (7) lower chord, (8) trim main rib, and (9) plate under trim main rib.

Two of these longons lie into the upper wing surface and form the upper edge of the nacelle tongue box, which consists of vertical side walls, extending from directly behind the nacelle compression ribs in the wing proper, and a horizontal wall extending aft 60 in. from the lower chord of the rear spar, top of the tongue box is the nacelle skin.

The two intermediate longons are arranged to make connection to the lower surface of the center section. Extending two longons stiffen the

structure at the bottom and form the mounting points for the leading gear doors—double skin structures with reinforced inner skin, reinforced by extruded frames at hinge points. Upper and intermediate longons are .182 and .372 high strength 30007 alloy, respectively lower longons are .125 24ST, with .052 doubler added.

Leading and trailing edges and nacelle are mated to the nacelle section to form the center section structural assembly.

Within the leading edge are provisions for mounting all engines, under

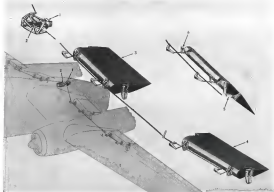
hairs, thrust, engine controls, fuel oil, hydraulic, instrument and fire extinguisher lines and electrical wiring. The leading edge encloses the flap controls.

Outer Wing Panel

Construction of outer wing panel is generally similar to that of center section. Leading edge has double skin construction for anti-icing, and lower spar section has similar ribs in the region of outer fuel cells. Outboard of this area, the main spar ribs are .025 hydroformed webs with flanged holes and stiffening beads and .064 rolled angle chord members.

Upper surface consists of stretched corrugation and outer skin. The corrugation varies from .132 at inboard and at front spar to .032 near the tip, and extends between spars for approximately $\frac{1}{4}$ of the span, and then tapers to a width about 8 in. at the front spar near the tip. Where the skin is not stiffened by corrugation, .853 and .080 Z-section stringers are used.

Lower surface is also formed with two-section corrugation externally covered with skin, and a center section stressed skin door is located in the region of the fuel cells. The corrugation varies from .851 at inboard to .028 at end of corrugation about halfway along outer panel, and is tapered from the end of the section door to the halfway point. Between the end of the corrugation and the wing tip, the lower surface is stiffened by macadamized chordless .025 hydroformed formers and spanwise .032 lat-section stringers.



Flap operating mechanism: (1) Main, (2) overwind cable, (3) flap link, and (4) flap operating lever.

The wing tip is constructed as a separate unit, is bolted to the outer panel, and is formed with .032 pressed ribs and chord stringers.

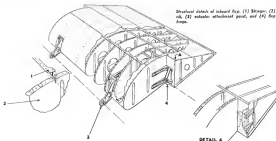
Flaps and Ailerons

Wing flaps extend for approximately 25 percent of chord, are NACA slotted type, and are constructed of pressed ribs and spars, the latter together with the leading edge skin forming the main structural element. Inboard flaps are approximately 5 ft. 10 in. long and extend from about 7 ft. 8 in. Each flap is attached to the wing by two hinge points at the end of the spar and two mounting points on the leading edge. Connection is made with ball bearing links arranged so that flap motion is, first, almost horizontal, then combining with little angular deflection.

As flap moves downward, angular travel increases rapidly to a maximum deflection of 40 deg. Operation is by an electric motor, located in the fuselage, aft of the rear spar, through the medium of a screw-and-cone type actuator connected to the flaps by a system of bellcranks and rods. In emergency, flaps can be lowered by a hand crank.

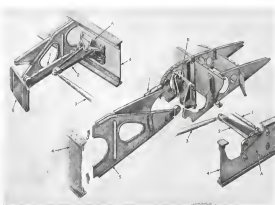


Aileron structure. Nose portion for metal skin, and entire assembly is later-inboard. Only right inboard shown for left.

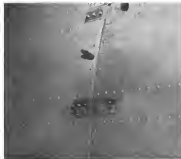


DETAIL A

Shedding detail of inboard flap: (1) Flap, (2) rib, (3) actuator attachment point, and (4) flap link.



Detail of aileron flap and handle: (1) Operating rod; (2) differential ball-rod; (3) pressure post; (4) rear spar; and (5) forward aileron flap.



Beam line in fuselage fitting and fuselage ball cam-rod line the joining beam (left) to fuselage (right).

The aileron installation consists of an inboard and outboard unit, the former containing approximately 13 ft 7 in and the latter 12 ft 4 in. They have pressed channel spars, pressed ribs, and steel skin to form the main structure, and pressed tail ribs. The entire assembly is fabric covered. Inboard and outboard ailerons operate as a single unit, and the inboard aileron is also fitted with a drop actuator to lower it with the flap when the latter are in landing position. This provides additional effective flap area, and still permits full operation of the ailerons as such.

Beam and Empennage

Constructed in two sections—forward and aft—the beam assembly is approximately 440 in. long, supports the tail structure, and houses various controls and tail air wing ducts.

Forward beam extends 328 in. from aft of the nacelle and is of semi-monocoque construction utilizing skin, light hydrogenated channel section frames fabricated in halves, and longitudinal bearing members. For the 180 in. from forward end, the

channel frames (floor—exclusive of ceiling frame) are doubled to form composite web built-in back. Longitudinal bearing members are 7357 aluminum varying from .025 to .064, with heavy gages on top and bottom because of gust and tow loads. There are ribs in many longitudinal members starting at forward end as those ending at aft end (20 forward and 10 aft, with 16 struts between).

Splice between nacelle frame and forward beam, and between forward and aft beams is of the bolted tension type employing lag bolts riveted to the structure; a riveted skin splice makes the joint non-permanent. Aft beam picks up vertical and horizontal tail loads, provides shelves to mount control pulleys, and affords sufficient side bending and torsional stiffness for glider tow fittings at engine end. These features are accomplished by employing heavy built-

heads, longitudinal members, and stressed skin.

Forward two lifting supporting bulkheads each consists of built-in back members having .008 web and .064 flanges. Between webs is a 4-in. plate for supporting the main stabilizer and stabilizer tips. Built-in type tension fittings mounted in channels take upper and lower tie loads.

Remainder of the frames in the tail row support the rubber torque tube and glider tow aileron mechanism.

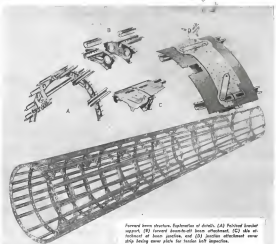
Between first two bulkheads are an upper and a lower shelf, each consisting of a web and angle caps, forming two horizontal beams to provide strength for side bending. The shelves are spaced sufficiently to provide ample service accessibility for control quadrants positioned between them.

On inboard side of beam, between it and the elevator, is a fixed elevator-shaped structure of width equal to

rubber throw, serving as a distance piece.

Provision for the towing two 7,000-lb. gliders at max 16,000-lb. glider is accomplished by the inclusion of a tow rope attachment at the end of each beam, together with a release mechanism selectively and electrically operated by a switch at pilot's station.

Main structure is standard two-piece construction with ribs and skin. Front spar is approximately 15 in. deep with web thickness varying from .025 to .040 from center to edge and angle caps are .126 in. the center and .064 at ends. Distance from front to rear spar is approximately 41 in. Rear spar is approximately 12 in. deep with web gage varying from .028 to .040. Lapped angle caps are .064 sealed triple in the center and tapering off to one angle at the end. Hydropermed interspar ribs and nose ribs, .023, are spaced approximately



Forward beam structure. Explanation of details: (A) Polished finished support; (B) forward down-chord beam attachment; (C) skin at forward end of beam section; and (D) fuselage attachment near slip fitting near pitch for tandem lift inspection.

in weight. Even so, the swing in power, alas, makes the ship cost less.

The comparison of a single strut on each side has proved thoroughly feasible, and offers an improvement over the more primitive two-strut version that why stop half way? There is no reason why the real goal of a clean, unadorned wing cannot be reached now.

In conclusion, the comparison of a centerline low-wing airplane with a stretched high-wing airplane is of course greatly biased against the latter by Types C and D in the table. In support favor of the strut-braced Type D we have more useful load which, however, does not cost good as for support flying, because the extra sample represents half required to overcome the extra drag. (Only is a little better due to the additional power, but is adequate in either case.)

In favor of the centerline type we have low power, weight, and fuel consumption, more top speed, less span and wing, and, what is probably a surprise to most people, still over \$100 saving in cost. Most must be added?

The designer's dilemma was, very few look at it. But for nothing has it become the prevailing standard of modern airplane construction.

Hard vs. Retractable Landing Gear

As brought out in the preceding article, the choice here depends largely on whether you are more interested at taking off or landing performance. On the basis of the performance specifications usually used, the most useful power for Types B and C was given by the maximum power landing, which made the total power required slightly greater for Type B with retractable gear. Although the power and fuel used in the maximum cruising speed is substantially less, Type B still has a

little more gross weight, and more weight empty in which facts cost as heavily depressed, especially considering the extremely high cost of mechanical parts (estimated selling price at least \$3 per lb.).

With cranking as the major criteria, however, the condition is reversed. Thus retractable gear permits a real saving in engine power and weight compared, with an actual reduction in purchase cost. This saving is still greater with tractor gear.

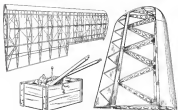
Re-Rated Power for Tailrotor

It seems reasonable to suppose that the relative importance of rated power for tailrotor will decrease in the future with development of improved lift control, extra take-off power, low-price adjustable propellers, or other idealized solutions, with a probable increase in the desired cruising speed, and with extensive distribution of more or less standardized designs. Here, now, while adhering to the very conservative power loading here assumed, adding 8 hp in the speed reserve is a considerable inducement for retracting the wheels.

At equal cruising speed, the engine is under less strain, and at equal output power, cruising speed can be stepped up 6 mph. Put another way, if this result were to be obtained by extra power (with attendant added weight and drag), it would take a total of nearly 150 hp, with a grossly more expensive airplane, for a "re-rated" version of Type C compared to Type B. (Incidentally, advantages of retractable gear include:

1. Ability to make a better landing.
2. Which more accessible for inspection, this indicates, etc., than with fixed gear.
3. Slightly better mileage over an obstacle than can be expected by design.

"But a centerline wing and had the difference in struts and wheels."



retraction of wing loading and power loading only, if the gear can be arranged to retract quickly as soon as clear of the ground.

A disadvantage is, of course, the added mechanical complexity, and the almost certain chance that a protractor, in spite of its advantages, will be longer to lower the wheels. For this reason, a straight-lift parallel structure, with some fixed lift exposed, makes considerable sense, besides being tamely simpler than the fully retracting type.

The decision. For much of the present market, an improved dual gear will probably get by, in the not distant future, at least partial retracting seems indicated for practically all designs.

Conventional vs. Bicycle Gear

The most concrete starting point here is probably the 80 lb weight (average) penalty for the bicycle gear, as established by the difference between Types A and B. According to our estimated cost scale, the corresponding difference in selling price would be on the order of \$7000.

Here we have a slight differential for which there is no direct economic justification, unless it is perhaps insurance. There has been such talk lately for bicycle gear, and it sounds good, but most people apparently neglect the fact that there is an approximate price to be paid for it. Our good result of this past article is that now we have plenty of experience, and only one more point, as having already been adequately presented in a number of technical papers.¹ But in addition to the cost, already mentioned, there are a number of disadvantages not so generally realized.

Most of the trouble with bicycle gear centers in the all-too-unavoidable nose wheel. From available records of lightplane with tractor gear, and of 13 accidents involving the landing gear, as only add any damage or responsibility attached to the nose wheel. The nose wheel was the culprit in all the rest. Although permitting an appreciable saving in the main wheels, a nose wheel takes away times the load and general persistence (as a tail

wheel). This fact is of course directly responsible for the extra weight. Indirectly, in the attempt to hold this weight down, the nose wheel is made too small and its supporting structure too flimsy. So it is an important requirement for the nose wheel, for us to correct behavior the whole nature of a tractor gear largely depends. The rear wheels are bent down, as deflected by ruts, or bumped into the air without stress effect on ground stability and control, but the nose wheel must be able to take it and live it.

Partially related to size also (overall diameter and moment of inertia) is the somewhat known as "front-wheel shyness," which is always a danger of a tractor gear, especially for light planes than for "hot-blooded" types.²

When of adequate size, a nose wheel is not only heavier than a tail wheel but also has more drag, which in turn means extra weight of fuel, etc., or the alternative weight of retracting means. And retracting a large wheel into the already crowded front end of a tractor fuselage will usually require some compromise of other desirable features.

Another undesirable feature of tractor gear on a normal lightplane is that in the extremely short nose which follows "steering" on rough ground, and is responsible for much of the nose-wheel porpoising mentioned above. Expressed more fundamentally, the length of wheel base, so important for many reasons, is the most tractor gear set ever had of what the length of fuselage makes available.

Although the nose wheel can always be put far enough forward to prevent a direct nose-over, it is still often possible to swing a wing up, and even to overturn diagonally, should one of the rear wheels leave the ground, due to a combination of forward and lateral motion (front steering with a high wing). This condition is aggravated by factors more or less inherent in "two-wheel" operation, particularly in a nose-wing landing.

Although the general safety of tractor gear must be left for later consideration, it is clear that, as at present understood, a two-wheel system means simply combining directional and roll tendencies in a single control. Whether this combination be by mechanical coordination or aerodynamic reaction is immaterial as far as the landing gear is concerned. The point is that if a wheel comes up, put on the nose control as you disengage the effect on roll is just reversed, as shown by experience as well as theory.

¹ "NACA Tech. Note," "Stability of Conventional Wheels for Landing Gear," April 1930.



If you want to raise a depressed wing in flight, you simply apply opposite stick (or wheel) with little or no change in directional loading. On the ground, however, the oversteering reaction at the wheel, induced by the steering, causes overbalance for the normally static rolling tendency. Thus the same control movement which will raise a wing in the air, invariably tends to depress it on the ground even when the wheel is not steered.

Ready dictated by the need for getting the tail down at take-off, the rear wheels of a tractor gear are automatically placed but a few inches behind the normal C.G. Under normal conditions, it is readily possible to rock back onto the tail, a condition termed some design authorities. Also calling for attention, not always noted in the design, is the early tendency for a mostly rear wheel to cause a pitch-up in the propeller. Such conditions can be remedied only at some further increase of weight, drag, and cost.

In a similar category is the problem of a nose wheel brake. With only the conventional brakes on the rear wheels, the landing gear remains on the order of 30% above the maximum attainable with brakes on all three wheels. This is because the forward wheel is not thrown on the front wheel by the brake force and inertia couple. Contrary to prevailing suggestion, a low-wing monoplane with conventional main wheels will forward wheel have a slower ground run than the same airplane with tractor gear, assuming brakes on the rear wheels only. But the added complication of applying a brake to a wheel when it is not steered is a terrible and usually should be retractable as an undemandable complication.

As economic disadvantage of the tricycle gear, best appreciated by airport managers, is that the nose-down method of loading storage can hardly be used without special baling gear.

It is true, the nose-down method of loading storage can hardly be used without special baling gear. The attention here can be best secured by by using both the nose and all air loads, at some time to say a few load weeks for the tricycle gear, or at least for what a really non-desirable. The attention here can be best secured by by using both the nose and all air loads, at some time to say a few load weeks for the tricycle gear, or at least for what a really non-desirable. The attention here can be best secured by by using both the nose and all air loads, at some time to say a few load weeks for the tricycle gear, or at least for what a really non-desirable.

1. The design must be such as to not require landing in any specially difficult condition.
2. There must be a substantial margin between maximum and minimum landing weight, within which there is no tendency to become or become up after ground contact.
3. Ground effects must be such as to provide accelerated forward motion.
4. Ground steering must be in the direction of the nose wheel.
5. There must be no undue ground-loading tendency.
6. Ground stability against oversteering must exist over full take-off speed, without changing in the wrong direction.
7. Strength must be adequate to give ground above a maximum take-off speed, not to be possible at any speed above a maximum take-off speed, not to be possible at any speed above a maximum take-off speed.

The tricycle gear comes closer to meeting these conditions than any other, relative to the conventional (1), (2), and (3) are met by the low ground angle, (4) by the steerable nose wheel, (5) by the nose-wheeling wheels behind the center of gravity, (6) and (7) are met by the fully retractable but can be best achieved by approached with a low-wing arrangement and some added weight. Condition (8) is determined by the longitudinal position of the rear wheels.

In view of this proven verdict, if forced to choose between the present conventional gear and tricycle gear in its present state, I should certainly choose the latter with all its faults. (As perhaps the last word hasn't been said, and I assume one might move for resolving the essential advantages of the tricycle gear, I should mention disadvantages, particularly its extra weight and cost, the world will make a better task to its own.

The decision for the class of plane under discussion, though it leads to say a few load weeks for the tricycle gear, or at least for what a really non-desirable. The attention here can be best secured by by using both the nose and all air loads, at some time to say a few load weeks for the tricycle gear, or at least for what a really non-desirable.

the firing points. Captured by the British armies of the landing bases in Holland, was necessary to estimate with the continuous V-2 bombing of London.

In the initial stages of a future attack, the former measures will be neither satisfactory nor feasible. How, then, to drive the long-range rocket bomb? It appears doubtful if cannon fire anti-aircraft, even under directed, will be capable of conversion into a successful defense. Ray brass weapons—no more futuristic than a 10 mm rocket plunging down from the upper reaches of the stratosphere—offer some possibilities, but remain to be studied here in more detail.

Of some immediate promise are super-bomb "hunter" rockets, stimulated by their target by electronic devices and capable of intercepting the long-range rocket bomb at high altitudes. Designed for comparatively short ranges of flight and utilizing the supersonic principle—carrying off fuel sections as their contents are exhausted and becoming reusable as it separates—the hunter rocket could reach speeds of over 6,000 ft.

Within the realm of possibility are automatic launching platforms, drifting slowly above the more important de-

fense areas at altitudes of 15 to 15 mi., each carrying one or more hunter rockets ready for launching at any object caught in the long-range radar beam. By thus eliminating the need for a climb through the dense layers of the atmosphere, these platforms would allow tremendous velocities to be attained by the "hunter" rockets.

Liquid-Fuel Rocket Motors

Great advances have been made in the past few years in the development of liquid-fuel rocket motors, both in this country and abroad. Use of improved materials and propellants has enabled the production of rocket units whose thrusts are measured in tons. Successful use of a rocket motor in developing an estimated thrust of 30,000 lb. for a period of over one minute enabled the Nazis to spring one of the more surprises in the war in their V-2. Introduction of this weapon, and more lately the rocket-powered Me-163 interceptor airplane, revealed the German lead in this field. Large scale research in this country got off in a late start, but it is now rapidly gaining ground. Jet-powered rocket, predicted in these pages two and one-half years ago (see "Rocket Power for Aerial Takeoff," Jan 1943) has since been

put into combat use by the Navy, both for carrier takeoffs and for emergency takeoffs of flying boats after sea landings.

However, despite the improvements thus far achieved with liquid-fuel rocket motors, the specific fuel consumption rate per power output has not been reduced below the best figures of 1 lb./sec. of propellant consumption per 200 lb./sec. thrust obtained by experimental aerial power jets.

The natural efficiency of larger combustion chambers has helped somewhat, but the liquid rocket is still voracious in its fuel needs. This is somewhat balanced by its generally lighter weight, which now easily is kept below 25 lb. per 3,000 ft. thrust.

Somewhat surprising to rocket engineers of former days was the discovery that the majority of takeoff units being used were utilizing a solid fuel charge. Because of the simplicity, ease of transport and handling, lack of plumbing, valving, pressure relief and expansion losses, the solid-fuel motor, with its fuel formed inside the combustion chamber, has gained the ascendancy for assisted takeoff and for other applications where a short duration burst of power is desired.

The "dry" fuel of today are a far

cry, indeed, from the old black gunpowder charges with which designers of liquid-fuel rocket motors contrasted these new powers. Many solid fuels used today are clean behind the liquid fuels on their thermal content. Improved combustion control now is almost almost constant thrust output to be obtained from large solid-fuel motors for periods approaching those obtainable with liquid-fuel units.

Thermal Jet Power Research

The obvious commercial value of thermal-jet power has already led not only the manufacturers of aircraft engines, but other large industrial organizations such as General Electric and Westinghouse to initiate development programs on this type power plant. Although the gas-turbine-propeller combination can have the advantage of more economical operation, the purely thermal-jet engine, with improved compressors and turbines allowing the use of higher grade fuels and higher combustion chamber pressures, will make the jet as economical as today's reciprocating engines when consideration is taken of the three factors of time, distance, and weight transported. The thermal-jet motor offers many advantages to the aircraft designer, as was strikingly illustrated in the development of the Lockheed P-80 Shooting Star, where the first model was designed, fabricated, and flown in a period of 145 days (p. 148 July). Elimination of the need for propeller clearances enable aircraft to be built closer to the ground, displacing landing gear doors, enabling servicing and maintenance to be more quickly accomplished, and facilitating loading of passengers and cargo into the aircraft. While replacing the ever-present, noisy whirling propeller blades, the jet engine introduces its own source of danger—the high-velocity heated jet.

The comparative simplicity of jet engine design will not maintenance costs and elimination of the complex ignition system, the constant-speed propeller, most of the lubrication system, and many of the present engine instruments, will reduce noise and running costs. Higher cruising speeds, comparable with the greater power in the jet engine, and the cleaner airplane which can be built around this power plant, will result in ultimate reduction of air travel costs.

Other thermal-jet devices, developed along the line of the intermittent firing V-1 motor and the subsonic—which strikes its internal combustion before ignition from the dynamic ram pressure of high speed flight—will be vigorously investigated not only for air-

craft motor use but developed as a competing method of powering special high speed aircraft.

With increased emphasis on long range weather forecasting, a more efficient method of gathering data from the higher levels of the atmosphere will be developed. The aerological sounding rocket, much mentioned goal of rocket experimenters during the past decade, is today a commercial practicality and may eventually replace the present radiosonde balloons. Although liquid fuels were previously accepted as the logical choice for the aerological rocket, recent developments indicate that solid fuel charges may compete even in this field.

Hyper-Atmospheric Research

With the alcohol-fueled oxygen powered V-2 reaching an altitude of 55-60 mi. there is small reason to doubt the desirability of rocket propulsion of the upper atmosphere at heights of 100 mi. and more. In fact, nations have it that the Nazis reached an aspect of 230 mi. with an experimental model launched straight upward. A generation of similar devices, with controlled acceleration for physiological returns, and equipped with fast recording instruments, could carry observers as remote as yet untouched by man. Hyper-atmospheric study of the cosmic rays and other phenomena of interest to the scientific world could be conducted under conditions far superior to those existing at a height of 112 mi. The present record ascent which was made by Captain Anderson and Stevens in Nov. 1935. This flight, made under the pilot auspices of the Army Air Corps and the National Geographic Society, portrays similar civilian-military operations of scientific research in pursuit years.



Aspect of municipal sounding rocket designed by Dr. R. N. Dethlefsen. From and power plants experiments of the government was able to secure cooperation enabling Dethlefsen to conduct research in rocket development.

any indication but for possible use at highspeed, been controlled aircraft carrying high precision mail, urgently needed air cargo and other commodities which, since the days of the pony express, have always moved at the fastest possible speed. The liquid-fuel



Has defense against rocket bombs of V-2 type rather supports a smaller, but better "hunter" rocket used in the experimental design in efficiency and immediate production.



Detail photo showing simple method of attaching P-48 rocket on F42. Launching tube is illuminated, as rocket is attached directly in storage. Note a flame arrester near (right) which shields before pilot takes off. (WPA World photo)



Pressurized Cable Sealed With Rubber

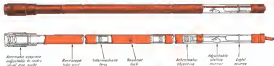
• In course of flow gas, application of Press-N-Seal to stress and joints of pressurized cables has been perfected by Chrysler Corp. in building B-25 prototype sections. Use of pressure gas cables work to be done more efficiently and less time faster than by hand application. Sealed by the method, leaking of rivets has been completely eliminated, reports Missoula Messing & Mfg. Co., contractor in riveting.



Bellhead Reworking Expedited By Use of Farming Machine

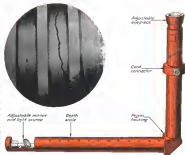
• Inexpensive distortion and elongation of work while working bellhead (sawed) design of this special machine by Curtis-Wright's Keweenaw Div. Consisting of a steel table with scales at edges for measuring

alignment, this forming machine is equipped with gas-operated clamps which move in unison, reshaping bellhead to correct contour without generating distortion so frequently found when all hand methods were used.



Machine's New Check Bars With Periscope Device

• Inspection of deep or small bore has been devised to an exact system by use of Periscope, which examines and enlarges interior surface, while projecting view of same in eyepiece connected to operator. Scale in outside of scope permits close examination of position of any defect which may be detected. Sketches show two types of device, while photo gives view of interior work as seen in eyepiece.



Roll-Over Waste Container Eliminates Heavy Lifting

• To eliminate use of extra manpower and to expedite handling of plant refuse, Floyd Wilson of General Electric's Erie division, built this rolling attachment for waste cans. Carried by tractor with forked lifting device, drum is dumped by being rolled after tractor lowers it to ground. Low CG automatically keeps drum upright even when tilted.



PRECISION THE GOVERNING PRINCIPLE

WOODWARD's largest and oldest exclusive manufacturer of precision governing equipment for prime movers, the 73-year-old Woodward Governor Company of Rockford, Ill., has gained worldwide fame for its development and constant improvement of hydraulic turbine governors. They were also the first company to produce satisfactory governors for diesel engines and variable-pitch airplane propellers.

Like so many metal working plants throughout the nation where precision is the governing principle, Woodward has for many years used Texaco Cutting and Soluble Oils to

ensure the finest machining, better finish and longer tool life essential for mass production of precision parts.

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The services of a Texaco Engineer specializing in cutting fluids are available through more than 2900 Texaco distributing places in the 48 States. Get in touch with the nearest one, or write:

The Texaco Company, 155 East 42nd Street, New York 17, N. Y.

RECONVERSION BUSTPROOFING

3 Points to Remember

- 1 Upon termination of war contracts, Government-owned production equipment must be reconversion properly, in accordance with official instructions.
- 2 Ordnance Specification P.S. 200-2 contains official instructions for the complete processing of such equipment.
- 3 These instructions require that only reconversion materials meeting Government specifications be used.
- 4 Texaco reconversion products meet Ordnance specifications for application on Government-owned equipment.
- 5 For full information, see past Texaco reconversion ad or write to us.



TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR MACHINING

TIME IN THE TEXACO STAR THEATRE WITH JAMES MELTON SPEAKS SUNDAY NIGHT—CAS

AVIATION, August, 1945

MAINTENANCE

Overhaul the Oil Instead of the Engine

New lube-oil clarifier adds great number of light hours to life of engines, doubling length of overhaul periods through periodical removal of sludge and other impurities.

ACCUMULATION OF SLUDGE in an engine gradually increases wear, clogs the oil cooling system, and spoils the overall fuel balance. Complete sludge removal, performed with sufficient frequency to prevent harmful accumulations, has enabled the engine overhaul period to be extended to as much as twice the normal number of flight hours.

Designed both to filter the oil and to purify it chemically, the Briggs Clarifier operates as a portable unit (Fig. 1). It is attached to the Y drain of the engine every 25 hr. By means of heated oil, forced through all parts of the engine and oil cooling system, all sludge and other foreign materials are completely removed and then filtered out, while chemical impurities are absorbed by the filter elements. Oil returned to the engine is, for lubrication purposes, equal to new.

Clarifier consists of a steam boiler, for heating both the oil and filter, pump for oil circulation, with its

gasoline engine; and clarifier, (Fig. 2), which is a pressure-tight drum containing 25 cylinders of filter's earth covered with cellulose (Fig. 3).

Principle on which clarifier operates combines both absorption of solid matter by cellulose and adsorption of chemical impurities and dissolved sludge by the filter's earth cylinders forming

the main lube-oil clarifying elements. In use, two units (Fig. 4) are engaged—first, the oil tank (Fig. 5), then the engine itself. When both units have been operated for the specified time (usually about 20 min. for a radial engine), both the oil in the tank and that in the engine are very close to new oil specification, while all parts

Fig. 1. Briggs Clarifier built as trailer with adjustable feet used for leveling. At right is steam unit being cleaned with, surrounded by jacket which acts as fuel for boiler, contained in left hand section. This part also houses pump and engine with valves and other controls. Fuel tank is at extreme left.



AVIATION, August, 1945

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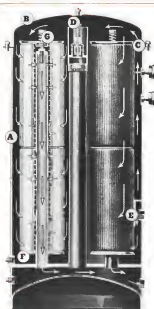


Fig. 2. Cylinder unit has (a) heavy welded shell having radial ribs greater than working pressure, (b) exhaust valve, (c) cover gaskets, and (d) relief valve which allows oil out at 500 psi and maintains pressure differential of 1500 psi versus atmosphere. Relief valve (e) is front of oil inlet distribution oil evenly among filter cartridges. Lamp (f) is for indication of heavy sludge deposited before oil passes through centrifuge. Centrifuge will assembly (g) is readily converted by taking out one top bolt.



Fig. 3. Top of separator shows filter cartridge assembly in place, with decompressing pump below. Legs of valve are for opening cover.

of the engine, cooler, tank, prop gas crane, etc., have been thoroughly cleaned.

Results, as reported by AAF, disclose that 8,000 engines which formerly required overhaul every 400 hr now have had this period extended to 900 hr. Several cases have been recorded where engines went for 1,800 hr, maintaining in good condition and apparently good for several hundred hours more. On disassembly, there was found only the normal amount of sludge which would be present after 50 hr of running.

Impeller plates, which usually give considerable trouble from sludge, were found to be free, there being no trace of any contaminant. The report credits the condition with the unusual freedom from trouble experienced with this part in the engines.

Cost of operation, based on oil destruction every 25 flight hours and with labor and supervision at \$5 per hour, would be about as follows for one engine:

Clarification (36 operations, 20 min. ea.) \$12
Replacement of filter units at \$3 per hr 36

Cost for 500 flight hours \$48

These figures show that the cost of more than doubling the time between engine changes works out to a matter of a few cents per flight hour—an advantage of considerable importance to both the operating and engineering departments of any transportation organization in air transport.

Filters' merits, in which the filter elements are made, governs the property of adsorption, which enables it to remove from the oil and remove dissolved impurities. This characteristic provides a much greater purifying effect than does a coarser which merely removes solid impurities mechanically, such as a strainer.

Because of this adsorption it is not practicable to clean out the filter units,

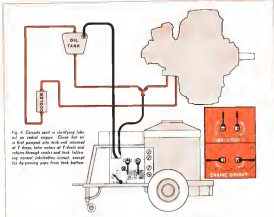


Fig. 4. Circuit used in clarifying tank and in radial engine. Clear oil at top is fed pumped into tank and returned to tank, later enters oil filter and returns through cooler and tank, follow top manual indication control, except for bypassing pipe from tank bottom.

which must be replaced after an average of 50 hr. use. This replacement costs about \$3 per hour of use (three engine oil clarifications). Because so few changes in necessary, a saving is realized which has been found to exceed in value the price of the filters.

In the air transportation field, advantages of this apparatus—as demonstrated by AAF results—should result in great economies in maintenance. Though the ultimate possibilities in aviation have not yet been gauged, it is of interest to note what has been done in the marine field, where reliability and economy are of as much importance as they are in aviation.

In a specific marine engine having cylinders with 16 in. bore, checked over an operating period totaling 10,546 hr, in 3 yr., bearing and piston ring renewal costs were reduced to \$49, as compared to \$2,658 in the previous three years when the clarifier was not in use. Due to improved engine efficiency, fuel savings were \$4,400 for same period, while cylinder wear was reduced to 5000 in per 1,000 operating hours as compared to 1004 for the same length of time before using the clarifier.



Fig. 5. Disassembly here is simplicity of conversion to radial engine. Tank showing result is illustrated, with top cover already open and lower being lifted by machine. Cooling is not disturbed.

Inspection and Servicing Of Aeromatic Propeller

PART II

Testing, static balancing, and replacement of blades are detailed in this concluding installment treating maintenance of this efficient aeromatic aircrew.

IF ASSEMBLING the Aeromatic propeller it is necessary first to mount the hub on the propeller boss.

After any bolts and shims have been inserted, install four any bolts with their shims, being careful that they are seated in their original holes. Marks 11L, 21L, 1L, and 2L indicate correct positions. All bolts should be tightened in pairs.

Before filling hub with oil, install oil filler plug and pump propeller on balancing stand. Balance on both edges in vertical, horizontal, and 45-deg. positions. Keep propeller in low pitch position during balancing.

If propeller is found to be out of balance horizontally, small amounts of washers may be added or removed from balance weight lead assembly on hub flange.

In extreme cases where sufficient weight cannot be handled by means of washers, the heavy blade can be removed and a small amount of lead wool removed from the hollow portion

of the blade shank to obtain balance.

Vertical out of balance is corrected by shifting both balance weight leads in the same direction around the hub barrel.

This will not affect the horizontal balance already obtained.

After the propeller has been balanced in all positions, the hub is filled with oil and the plug secured in place.

High and low pitch stop readings should be checked with protractor and the correction, if any, made by altering the amount of shims beneath the hub leads.

Low pitch should be within 0.1 deg. and high pitch within 0.5 deg. When changing shims, there should be assurance that blade roots against stop bolt before loosening other pins.

After shims check, air propeller with 3500 rpm oil and attach oil gun and gun. 3500 lb. oil with oil and then pump up to 5 psi. Exercise hub for balance and watch pressure to see that it does not drop.

Before oil pressure, remove pins, and take out all surplus oil in just up to hole when propeller is on assembly table with lowest cone up. Replace and safety-wire filler plug.

When reassembling new blades, remove counterweight lockwash and disassemble. Screw new blades into flange to give same riding as before. Adjust according to markings stenciled on blades. Screw special drill hooking 2642 into counterweight hole. Then check of No. 3 and 4 through bushing hole and into flange. Tighten counterweight bolt not using 55 ft. lb. torque. Fasten with correct pin. Remove drill shaft and drill blade shank with same drill bit



Fig. 19. Blade lock bearing is placed in end of flange for blade No. 1. Remove counterweight lock and replace blade flange. Lock flange with bearing into hole with your left hand and spreader blade. Press all oil ring in groove between outer bearing race and blade base, using grease to hold it in place. Then place bearing (with its packing ring) on flange with grease side of packing outward.



Fig. 20. Attach assembly tool (Tool No. 5, Fig. 26) to flange No. 1. Hold propeller over in place and push with both on flange, inward and holder counterweight side. As work, then remove them in place, making sure that correct cone have been used. Blade No. 2 is correctly seated by holding both blades against stop pitch stop bolts.

depth of fit in. Remove drill bushing, small lockwash, and safety-wire it. Drain oil from propeller and blades. Small changes may be made with washers, as already noted.

Build propeller with oil, then test on engine. Engine rpm, as given, at full throttle, should be as specified.



Fig. 21. Place packing assembly tool No. 8 over flange. Insert release snap ring in lock hole and adjust flange screws of assembly tool until packing pressure made fairly uniform during. Use snap ring assembly tool No. 8 to retract snap ring and fit of oil lock groove. Insert packing tool No. 8 through both flange and turn to left until all flange plug is removed. Tighten further to packed bearing slightly. Then hold in that position, while holding the plug which holds gear lead screw. Check locking after it goes to have packed screw inward. If not tight, packed again and retight, holding in before flange loosened of screw with protractor. This should not be more than 1/4 deg.

Otherwise low pitch stop bolts should be adjusted.

After low pitch has been pronounced satisfactory, engine should be checked.



Fig. 22. Coat flange and ring with grease and place in most end of flange hole, checking it slightly, if necessary, to assure it stays in place. Place flange and plate against ring and attach tool No. 12 compressing ring uniformly to clear snap ring groove. Insert snap ring with tool going on inside side of flange, working in its way if in place. Repeat operation on flange No. 2.



Fig. 24. Is balance weight assemblies have removed, install and tighten with 3500 lb. torque. After assembling both flanges, remove blades into flange, using blade screw No. 1. Place new blades into flange without first using carbon or a mixture of 70% white lead and 30% engine oil. Blade shims are changed into position as specified. Use 3500 lb. torque in order position. These steps is repeated in same manner as before assembly.

in flight at full throttle, and specified rpm. Slight changes in rpm may be obtained by adding to or removing thin disks under nut on crankshaft end of bolt. Removal of disk 2) in disk 4) in thick, will add about 30 rpm, while adding same weight will reduce rpm, by same amount.



Fig. 23. Lubricate counterweight lock flange with carbon grease. Place counterweight sufficiently for lead on flange to permit snap ring to be installed, then work counterweight over snap ring. Flange and oil weight should be turned hub with longer weight seat and insert lubricated snap half in one and then oil on flange.



Fig. 25. To check leveling of blades they are supported by blocks to prevent twisting and greatest due a straight against a square as bench under the square is then moved to opposite blade and it is placed on bench under line to check alignment of blade under which should be within 1/32 in.



Fig. 17. Place tool bearing over flange with top-down, under cover and flange shoulder. Place two packages in series of release with general seal surface, and then between packages. Place surface and packing on level bearing and apply packing compound tool (No. 10, Fig. 26) as per. Glycerine between service plate and bearing should be between 0.010 and 0.020 in. Use, use more than bearing packing. If release will hold only one packing, all shims may be added before packing is set in place.

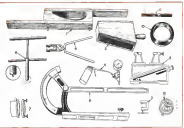


Fig. 18. Packed pins, which fill play out of assembly, are first installed. Lubricated, packed screw is turned as far as possible into bearing disk for No. 1 blade. Then pin play is removed evenly into center of packed screw, and packed screw is aligned over disk. Pin play in for locking packed screw by separate after adjustment of shims correcting ball bearing.



Fig. 20. Attach assembly tool (Tool No. 5, Fig. 26) to flange No. 1. Hold propeller over in place and push with both on flange, inward and holder counterweight side. As work, then remove them in place, making sure that correct cone have been used. Blade No. 2 is correctly seated by holding both blades against stop pitch stop bolts.

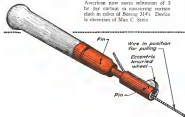
Fig. 26. Here are special tools for assembling Aeromatic propellers: (1) is blade wrench, (2) block for holding blades in steady position, (3) counterweight operator, (4) oil gun and detachable pressure pump, (5) assembly tool for its position of flange for angular assembly, (6) protractor for measuring blades and counterweight angles, (7) packing assembly tool for holding packing in place, (8) protractor for the counterweight bearing packed screw and pin plug which leads it, (9) release snap ring assembly tool for compressing snap ring, (10) packing compound tool for lubricating flange packing clearance, (11) protractor adapter for use with protractor in measuring angle of counterweight shims, and (12) flange and snap assembly tool and for compressing tool flaps while assembling snap rings. (Note dimensions shown.)





Adjustable Template Saves Both Cloth and Time

• Using standard 3-ft. rulers clamped to crossbar, with flexible lines attached to give correct curve. Dan American now saves minimum of 3 hr. per canvas in measuring certain cloth in cabin of Boeing 314s. Device is invention of Max C. Stern.



Hot Bath Removes Prop Tipping

• To remove rubber tipping from propeller blades, UAL uses vertical, tub-like bath, heated 4 ft. in ground. Filled with water and heated by steam introduced at bottom, tank enables rubber strips to be removed after 5 min. soaking. Outside of tank is asbestos-covered sheet floor level, and special grip is provided for handling blades while in hot water.

Cable Gripper Grips Automatically

• To tighten cables and small wires without danger to hands, G-E mechanism made this grip by placing a small, eccentric, knurled wheel on end of worn-out motor-driven shaft. Knurling not only gives non-slipping cylinder but enables wire to be released by finger motion.



This Adjustable Elevator Leads Freight Quickly

• To accommodate different heights of loading doors in airplanes, C & S manufacturers design built this adjustable self-storing package elevator. Frame is of welded steel tubing, with elevator hinged at lower end and supported near top by swinging trip knees provided with rollers, which bear against elevator lower frame. Crane used for raising elevator runs along side of frame.



Detail of elevator raising mechanism. Vertical tubular frame is hinged at base and is moved back and forth under elevator by long screw attached to hinged center of crossbar. Chain-operating nut on rising screw is driven by geared shaft (bottom center) which runs down to right-hand side of operator.



Wheels at lower end swivel to permit aligning with glass. Machine is locked freely in place when operating by means of hinged shoes to left of wheels. Hand crank for rotating is at left of geared rail. Reversible motor and gearbox are under lower end of diameter with mounting screws above, due to operator's hand. This machine will handle baggage or freight as fast as one man can load it.



**Painted Shop Marks
Curb Landing Strut Damage**

• Breakage of nose wheel struts and axioms through tearing too sharply was cured by Vinton Ferrill at Marine Airport by painting bright red marks which line up 5 deg. before danger point in turning. Marks are easily visible to tractor operator when towing plane.

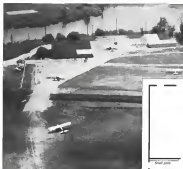
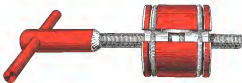


**Air-Cylinder Equipped Wash Tank
Prevents Accidents and Saves Time**

• By equipping parts wash tank with vertical air cylinder, which automatically raises traps and opens lower cover, UAL's Cheyenne base saved considerable time over former method of removing parts from the washer. Heavy hand iron behind cylinder both opens cover and holds it in position, while parts are removed, avoiding danger of injury through falling cover.

**Pole Shoe Expander
Prevents Damage**

• To avoid damage to pole shoes, which occurred when overdriver was used to force them in place when re-winding starter motors, Sigs J. W. Turner and L. M. Hansen of USA ASC (England) devised this expander which forms them into position without scratches or damage. Semi-circular halves are forced apart against pole shoes, by wedge-shaped center pins driven together by right- and left-hand screws turned in handle. Re-winding time saved was seven days in eight.



Over-eye view of Otto Aviation's Lake Sequoyah base shows placement of hangars, parking space for planes, and portion of landing field. At left is main hangar which also houses office and ground school, while at right maintenance hangar can be seen. More details about at upper left.



Shop layout of new base shows: (a) Ball press, (b) hole saw, (c) lathe, (d) welding equipment, (e) air compressor, (f) portable pump system, (g) portable parts rack, (h) saw (i) tool cabinet and vice stand, (j) motor press, (k) Magnaflex engine, (l) Magnaflex motor, and (m) lathe shop.

OTTO AVIATION PREVIEWS N. J. BASE

Lake Sequoyah Airport, opened as fixed base operator's new headquarters, houses school and overhaul and maintenance shop, also serves as terminal for subsidiary airline. Shop features lineup of practical facilities for reconditioning craft.

SITING AT BLAINSBORO, N. J., twelve miles northwest of the Delaware Water Gap, Lake Sequoyah Airport, new operation base of Otto Aviation, Inc., was recently opened in an outgrowth which afforded what may be a preview of the healthy business potentials awaiting fixed base operations in pioneer aviation.

Started almost from scratch a year ago, the airport has been completely rebuilt into a model base housing a ground and flight shop, an overhaul and service shop. The port also serves as a terminal point for the company's newly inaugurated passenger route between North New Jersey, the New York City metropolitan area, and Atlantic City.

Although present facilities are aimed to be complete enough to handle current business, further expansion is planned when more materials and equipment become available.

fixed clear space beyond the field's boundaries, free of trees or other major obstructions. And within very short walking distance of the airport there is a resort-hotel with all types of recreational facilities available (later was described on page 196 May 1946 Aviation).

A fleet of Aeromacs and Paper Cubs are used for student instruction and also by licensed pilots who wish to keep up their flying time. The Aeromacs, which were formerly surplus AAF O-51's, were reconditioned at the base by Otto Aviation and are now almost identical to the Aeromac TAC model. In addition there is a Waco UPT-7 for (Turn to page 245)

MAKE IT EASY ON THE PROSPECT

New wrinkles on old methods of getting the product before the potential customer—to get more sales.

SUCCESSFUL MERCHANTS of aircraft and aviation accessories are already moving into new circles and reaching new means of cooperation as well as competitors, realizing that the postwar dealer and distributor may well be adapting methods unnecessary in the so-called "good old days."

Fortunately, however, practically all

of these new angles of basically sound and long-proven distribution methods are within the reach of any enterprising dealer. And they can easily be adapted to one or modified slightly to meet local conditions. The main ingredients of such ideas, as discussed by the examples shown herewith, is initiative.



Taking the engine right to the prospect. Here a Lockheed B-24 Liberator is being shown to a group of prospective buyers at the Ohio Air Show. This display was held there, for it was set up at last

conspicuous in our aircraft leasing program. Shown right above, plane mounted on a set of rails, so that it can be moved up and down the aisle.

Cooperative advertising by M. operators in and near Cleveland. Business was developed as first day of operation, and results proved as satisfactory that even in low competition areas without change. Low of distribution, which does not apply, when each selling agent has his own territory from which to draw, and those located in Cleveland Municipal Airport after different types of services.

On Cleveland Municipal Airport is convenient to transport in, as well as local flying — is the Cleveland Municipal Airport. Business was developed as first day of operation, and results proved as satisfactory that even in low competition areas without change. Low of distribution, which does not apply, when each selling agent has his own territory from which to draw, and those located in Cleveland Municipal Airport after different types of services.



AVIATION, August, 1945



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generally designed before the flying season. However, the surrounding program includes various activities, such as, and other programs designed to give the student a chance to develop their skills and abilities.



Is CAB Regulation Of Airline Securities Necessary?

By JOHN H. FREDERICK, Professor of Transportation, University of Texas

Analyzing the Board's renewed request to Congress for authority over air carrier stocks, this transportation expert finds the answer is as emphatic "No."

IN ITS RECENTLY FILED annual report for the fiscal year ending June 30, 1944 the Civil Aeronautics Board again made a request to Congress that it be granted legislative authority to control airline security issues and capitalization. In making this request, the Board pointed out that such regulatory power was considered necessary to "insure the development of economically sound capital structures." The Board also mentioned that the Interstate Commerce Commission already had such authority over the carriers under its control and that this was a reason why it should also be granted such power.

From this statement it appears the

Board feels the financial situation of the airlines is akin to that of the railroads before control of these security issues was assumed by the ICC under the Transportation Act of 1920—or that the airlines may get into the same shape. Truth of the matter is, however, that nothing could be more different than the financial structure of the railroads before and since 1920, as compared to the past and present financial structure of the airlines.

Federal regulation of railroad securities was necessary because these carriers had great quantities of various types of bonds outstanding. These interest charges on these bonds were naturally in proportion to the volume

of securities issued, and the revenues to meet these expenses were necessarily derived from shippers and passengers. The airlines, on the other hand, have no bonds outstanding at this time. Not one of them has any funds debt at all, since they are capitalized wholly on the basis of stock, either common or preferred, with only those having any of the latter.

Of course, those who make use of the railroads or the airlines have a direct interest in the robust and character of the securities issued by each carrier. The belief, now widespread, that, owing to the competitive and other economic conditions, as well as government regulation, there is no direct relation between common carrier rates and capitalization is no longer held to be true.

In rate cases where rate schedules, rather than individual rates, have been involved, the railroads have nearly always attempted to show that their net income after paying out of operating and fixed charges has not been sufficient to yield a fair return to stockholders. The need for increased revenue through increased rates has, therefore, been urged. Under such circumstances it is of vital interest to shippers and other users of a railroad whether the outstanding securities of such a carrier represent actual value and are entitled to a share in its earnings.

In railroad history there have been many cases of financial mismanagement, to say the least, and it was felt back in 1920 that since, as mentioned, a large share of the public had been affected by the amount and character of railroad securities issued, it therefore merited the protection of Federal legislation to assure that funds were being wisely used and investments protected from excessive financial speculation.

Federal regulation of railroad securities was also thought necessary to protect the carriers' themselves from any involved financing which might impair their ability to furnish their special service, performance of which was the reason for their existence, and upon which they depended for their livelihood. Without such regulation it was possible for a limited number of railroad companies, by speculative and irresponsible financing, to bring all railroad securities under suspicion. If this happened it would be difficult for

(Turn to page 252)

"Elastic Traffic" Plan Advocated For Building Feederline Business

By JOHN W. MOORE, Air Transport Traffic Manager, Post of New York Authority

Pointing out that it's the flexible service which will best meet the variable demands of feeder transport, this traffic analyst advises special-stop certificates for feeder airlines—certificates permitting the operators leeway in their schedules and steps so that they may take greatest advantage of seasonal traffic fluctuations.

IT is the popular expectation that the feeder airline and the trunk airline are closely related in a kind of "little brother and big brother" kinship. True, they have a great deal in common—but their operational problems are quite different.

Trunklines, which primarily serve the principal traffic centers, operate under an authorization which definitely fixes both the service and all time-schedule points. If mail is carried, schedules and time of departure are prescribed by the Post Office Department. The only time a trunkline stops at a small intermediate town is probably only a limited amount of traffic—in which such a call is required for operational or testing purposes.

The sole hope of most small cities and towns for air transportation lies in the intensive development of secondary service or feederlines. Such business as that offered by small non-industrial towns, out-of-the-way beach and mountain resorts, or by seasonal passenger and seasonal express traffic, or general schedules involving short runs and frequent stops at small airports, are not attractive to the trunk airlines. But, taken as a whole, there is sufficient business to support an efficient feeder service.

As now constituted, regulations call for certificates specifying certain definite operations—so many flights to so many places, at six almost no latitude for variation. This system was formulated for trunk airlines and with them it works reasonably well, because their volume of business permits them to maintain operations over the same schedules and make money doing it.

Consider, however, the plight of the non-trunkline operator under this type of certificate. It is extremely unlikely that feeder service will compete with the major airlines for air traffic between the larger cities. The necessity of stopping at numerous small and remote localities as route means that the time schedule will be considerably slower



State of New York, with 2,000,000 population, has 17 airports, with 100 scheduled flights. Only one airline, the New York Airways, has scheduled flights to all 17 airports.



New England and New York City have 40 airports serving 15 million people who can't travel by air without first going to another town. This is a typical American facility.



COORDINATED CONTROLS RELIEVE FLIGHT FATIGUE



Forward section of Boeing C-97's control cabin. In left foreground is flight engineer's control chair. Behind it is pilot's seat and at right a co-pilot's. All principal instruments are mounted on panel in front of pilot's panelled window and electrical controls are on the instrument panel and all engine and accessory controls are on radio control stand between pilot and co-pilot. Arrangement permits one man to fly big craft in emergency, (AP Wire photo)

New instruments of airplane control cabin efficiency—simplicity and consolidation of controls, convenience of operation, and visibility—are to be found in the new Boeing C-97 AAF transport, the military counterpart of the company's post-war Stratolifter airliner.

Five persons occupy the C-97's flight crew—pilot, co-pilot, flight engineer, navigator, and radio operator. Pilot and co-pilot are seated in the nose, some from the cabin side windows. Navigator and gun behind them is the flight engineer. The navigator's position is directly behind the pilot, while the radio operator is stationed behind the co-pilot.

On a normal long-range mission, the full five-man crew is carried, but on short-range flights it is impossible to fly the C-97 with only a pilot and co-pilot. Furthermore, the plane's controls are so located that in an emergency it is possible for one man, seated in the co-pilot's seat, to operate the big craft.

Boeing's arrangement organizes the various classes of equipment required by pilot, co-pilot, and flight engineer. Approximately 70 instruments and 55 switches comprise the operating

controls. All principal instruments are located on a panel in front of the pilot. Principal switches and electrical controls are placed on an overhead switch panel. All engine and accessory controls are located on a central control stand which is immediately in front of the flight engineer and between the pilot, consequently accessible to all three men. It is this central control stand, probably the outstanding feature of the C-97's control cabin, that makes possible the abbreviated one-man operation of the plane from the co-pilot's seat. Except for certain fire control equipment, all operating controls are also available to the pilot.

All instruments may be read and, except as noted above, all switches and controls may be reached by the pilot and flight engineer. However, instruments, switches, and controls are so positioned as to make them extend to read as far reached by the crew member whose normal function includes the use of that particular device. For example, the vacuum selector valve and fuel selector controls are located in the flight engineer's window, and the pilot, since these operations are normally a flight engineer's function.

This location of a single control stand in the center of the cabin provided the usual arrangement of flying the two pilot seats back with the side windows. However, adequate forward vision is provided by judicious placement of side windows. The No. 3 engine can be seen by looking through the radio operator's window, and the No. 2 engine is visible through the navigator's window. The two outboard engines are viewed through the windows alongside each pilot. Vision directly aft is provided through the astrodome, which is on the top center line of the fuselage directly behind the flight engineer's station.

Being C-97's centralized control cabin features special instrument layout and single control stand so located as to enable one crew member to operate big craft, also permits better crew teamwork.

Since the pilots are seated directly in the plane's nose, with its large number of windows (most of which are distributed so as to prevent distortion), the general flight vision up, down, and forward is excellent.

With pilot, co-pilot, and flight engineer in such close proximity, most crew coordination between them is accomplished with a minimum of effort. Since levels in the control cabin are little higher than those of the average busy office, and communication can

be carried on in normal tones. During long-range flights, two of the three men can leave their flight stations for relaxation, since it is not necessary for more than one of the trio to be at his post during routine cruising conditions.

With the navigator located directly behind the pilot, and the radio operator behind the co-pilot, communication between the crew is possible without using microphone equipment.

The navigator has a table which will handle many charts laid flat, and he also is provided with a compassboard storage compartment. He uses the astrodome by standing on a glassine pad (available in the proper height). The radio operator also has a table and cabinet, with all his equipment compactly and conveniently located. This equipment is attached to the rear face of the central control stand and is removable when not in use.

That the C-97's control cabin arrangement is efficient was proved during the first craft's operational flight last January when it flew from Seattle to Washington, D. C. in the record time of 6 hr., 33 min., 50 sec.

To the occupants of the control cabin, the C-97's ease of operation, convenience, and comfort was the most noteworthy feature. They reported that the trip was made without fatigue or strain and that they felt fit and ready to start a return flight to Seattle at once.

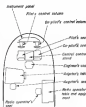
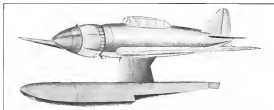


Diagram of control cabin arrangement as C-97 shows location of each five-man crew and placement of control control stand adjacent to pilot, co-pilot, and flight engineer.



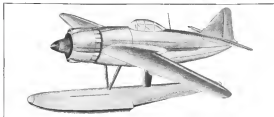
Radio operator of C-97 is seated behind co-pilot at rear of his control stand.

Engineer is located on port side aft of pilot. He looks forward.



Improvements Evident In New Jap Seaplanes

Recently introduced high-powered fastgliders are smooth-looking craft, with much attention given to streamlining. Designs seem to indicate that Nips have not been sacrificing research for quantity.



Reinhold *Nemo* 17 is a two-part single-head specimen used for *non-reinforcement*. App name is *Blau* (Polished Chisel). *Forward* by *litter* a 7,400 lb. Mitsubishi *Race* 14 *trial* engine or a *Race* 26 of 1,228 hp. *coll* has *several* *animal* and *intriguing* features, including *undercutting* *propeller*, a *large* *attached* *blade* *section*; *carving* *active* *kind* of *engine* *and*, and *fully* *retractable* *wing* *flaps*. *Nemo* has *single-type* *aircraft* *shells* and *large* *unattached* *flaps*. *Construction* is *aluminum*. *Spans* approximately 46 ft. and *overall* *length* is *aged* of 37 ft. 7 in. *the* *performance* *are* *annual* *details* *are* *yet* *available* (blasted by *Amelia* *last* *year*).

Keweenaw Reef Pt is a single-phase single-bed light. One while Wip's buoyage system was not relaxed. Since it was more similar to that of Wip, except that Keweenaw's buoy was in a lower position. Powered by a 1,000-hp engine. Multiple (Navy) 1000-hp engine. Has a top speed of about 40 mph. Wip's buoy was remarkable for its old hull and with Wip's performance was on Nemo. Speed is about 40 N, and can't be as great. Length of approximately 25 ft. Top area for Keweenaw is 100 ft. Long.

FLYING EQUIPMENT

Spartan Building 4-5 Placer For Business Flying

Graco is to be an improvement on power Executive 7W, with new features to include magnesium components and retractable tricycle landing gear. In \$14,000-\$20,000 class, designs will include mail and cargo pickup versions.



Here is a meeting of *Spectra Executive II* showing retractable flyrod loading port, an optional *Jetfish* for a radial engine design. To be powered by a 480hp *F4U* Whop, Jr., craft will have an estimated 300 mph cruising speed. Other key points, in red, and standard: no free suspension components.



Notes of Swatch's master designer working and Japanese legends. Swatch will show from similar exhibits. Language is to be accessible from other exhibits as well as from outside. Swatch and people's interest will be enhanced on important point. Learning your and days are to be absolutely avoided.

and it is stated that the load could be increased as fuel is consumed.

Luxurious furnishings are planned for the cabin interior, including foam rubber cushioned seats. Head rests, window drapes, magazine pockets, map cases, and ash trays are optional equipment. The luggage compartment is to have a large outside door, with lock, a

material to protect luggage. Pressurized forced air ventilation will be included, while heat will be available from a device utilizing air passing through the engine oil cooler in order to eliminate any possibility of exhaust gases entering the cockpit. Landing gear and split wing flaps are to be electrically operated.

It is stated that the new craft will
(Turn to Page 256)

Specifications and Data

[illegible]

Capacity



Modern, large capacity equipment, skillfully operated and carefully supervised, assures quantity with quality.

...to deliver molded oil paper capacitors . . . in quantities more than ample for your needs . . . and in exact agreement with American War Standard C75/221 . . . is afforded by batteries of these dual-77 cavity monitors. Fed with oil-impregnated, aluminum-foil wound, non-inductive sections and pre-forms of mica-filled phenolic, these huge presses are continually pouring forth capacitors of uniformly high quality with the consistency of characteristics for which Tobe products are famous.

So, however great may be your consumption of molded oil paper capacitors, Tobe can deliver them in volume. Capacitance ranging from 1000 to 50,000 mfd.; working voltages from 120 to 800 volts d-c; ohmic resistance as high as 40,000 megohms at 25°C; power factor as low as 0.004 at 1000 cycles; and moisture seal that meets all thermal cycle, immersion, and humidity requirements.



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Tudor and New Aerovan Groomed for British Airlines

Among many in British postwar commercial aviation projects was seen in the recent appearance of two new craft, the Aero Tudor I, a 34-passengered cabin version, and the unorthodox-looking Miles M-51 Aerovan, a small wooden craft especially designed for aero bus operators, general aviation work, or even flying at commercial rates.

Aero Tudor I. First British luxury airliner to make its appearance is the Aero Tudor I, which was flown for 38 min on June 14. Production is scheduled to begin this month, and BOAC has placed orders for 28 of the craft, which are intended for use on trans-Atlantic runs.

Of all-metal construction, the Tudor is powered by four Rolls-Royce engines in new-type cantilever cowling, and fitted are four-blade D11 hydraulic feathering and reversible pitch propellers. Rated top speed of the Tudor is 246 mph at 20,000 ft., and cruising speed at this height is given as 206 mph for an estimated 3,700-hr. range. Maximum range, at the same altitude, would be 4,500 mi., flying at 230 mph.

Span at 120 ft., length 86 ft., and height, 18 ft. The struts feature 14 ft. in dia., and a pressurized cabin atmosphere pressure equal to that at 8,000 ft. is placed. In addition, both cabin and flight deck are un-cabinized. Ramp and freight capacity is stated to be 8,750 lb., and disposable load is said to be 36% of the craft's total weight. Fuel capacity is given as 2,400 gal.

Accommodations are to be provided for twelve passengers, employing lounge chairs which are convertible to berths. This would be the standard arrangement for distance flights. The "day" version will seat up to 24.

It is stated that in several months a larger Aero Tudor II will be ready to make its first flights, and production on that design is expected to begin early next year.

Miles M-51 Aerovan. Called one of the most versatile airplanes yet produced, this new Miles craft is a high

Two widely differing craft make their appearance — A crash 24-seater for trans-Atlantic routes and a light passenger-cargo "aerovan" type for low-cost operations.



Developed especially for low cost operation, Miles' new Aerovan can be powered by two 200 hp or 300 hp engines at 240/250 hp, each. Internal legs are of Miles design, and a large single side-cargo door is fitted at rear of fuselage.



New Aero Tudor I airliner, 28 of which are scheduled for use by BOAC in trans-Atlantic operations. Powered by four Rolls-Royce Merlin engines in cantilever cowling, craft is designed to carry 24 passengers at a top speed of 246 mph. Design is akin to Douglas DC-3 and Conquest Commando.

wing monoplane, mostly of wooden construction, and with power supplied by two Gipsy Major or Conquest Major engines in the 140 hp/152 hp-ratio class. The manufacturer gives none of the proposed uses of the new craft— as a flying caravan for the air tourist, as a light passenger or cargo plane, as a flying operating room, or for aerial pickup.

Of teardrop-like shape, the fuselage is

all wood. There is a fixed tricycle landing gear with main gear retractable, and the nose wheel is steerable. The high-mounted tail boom is all metal, and to this is attached cantilever tail surfaces fitted with three fin and horn-balanced rudders. The control cabin, which also will seat an extra passenger, has a very large molded Perspex windshield, affording a wide

(Turn to page 253.)

We built the skill of the craftsman into the machine!



In every way for a Hyatt Roller Bearing were painstakingly fashioned by expert tool makers they could be as more concentric or of more uniform wall thickness than obtained by our centerless grinding machine production.

First we externally grind by our improved rollerless grinding method. Then the perfect outside periphery thus obtained is used as a guide in grinding the inner diameter of outer races, the track upon which the rollers operate.

This new principle invented several years

ago by Hyatt Methods and Equipment Engineers we call "Chuckless Grinding." Thus into the machine we built the skill of the craftsman and precision manufacture at a mass production pace was born.

This is just another example of the many exclusive manufacturing processes which enable us to build accuracy, longer life and more dependable performance into Hyatt Roller Bearings for every application.

Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

FINANCE

WALL STREET EYES THE LIGHTPLANE MAKERS

NOT THAT CIVILIAN AVIATION IS gradually coming back into the spotlight and private planes are again in production, Wall Street is beginning to show interest in the personal plane companies for the first time.

So far this interest has not resulted in any large scale buying, but the brokers are definitely busy, most on behalf of themselves with this important group in the aircraft industry and in weighing carefully the pros and cons of their potential prospects.

Already two schools of thought have appeared in the financial district regarding the civilian plane companies. Some stock market analysts are in accord in favor of speculative investments in this group, while others are just as firmly "against" on.

Argument of those who like the personal plane manufacturers runs something like this: "The war has created new markets for the personal plane market; 400,000 civilian airplanes are expected to be sold within 10 years after the war, compared with less than 25,000 at the close of World War I. Some of these 'fliers' will be post-war personal aircraft sales at approximately \$700,000,000 within 5 years, compared with prewar sales of only a few million dollars a year.

They point to 4,000,000 potential flyers. There are, they say, 350,000 Army and Navy pilots, and 150,000 civilian pilots and students, in addition to 3,500,000 who are trained by the armed forces in other aviation fields and almost the same number that have been employed in aircraft plants. Then adding 150,000 high school aeronautics students, they arrive at the 6,000,000 prospective aviation figure.

Some are bullish on the personal plane company outlook purely from the merger angle. These comment, they say, that, while speculative opportunity in the chance that some of the big fellows will want to get quickly established in the personal plane field via the merger route—buying up small companies that have a successful personal plane production record behind



By RAYMOND L. HOADLEY, Financial Editor, "Aviation"

Some investment advisors say, "Get on the headwings;" others advise, "Wait and see." Here are the factors behind these divergent lines of reasoning.

There have been some preliminary negotiations during this time, but nothing ever came of them.

As an alternative, they point to the attractive possibilities at two or more personal plane companies leading together in a combination, something akin to the above-mentioned Beech-Cessna merger. In this case, it is noted, the new outfit was to have a leased line of 25 to 15 passenger jobs to offer the public under an distributor's contract. Officials of Beech and Cessna anticipated substantial operating and manufacturing economies, while another advantage expected by merging was expected working capital of the new company.

However, in the week following the usually strong merger move, the stocks of both Beech and Cessna moved up only about one point. And then in a week when aircraft stocks generally were strong on the stock market.

One of the strongest arguments made in favor of the personal plane stocks is similar to that advanced for the so-called independent automobile

stocks. It is pointed out that the very same activities of a number of the personal plane makers have enabled them to expand their plants and personnel and, what is equally important, strengthen their working capital position.

The sales totals recorded by twelve personal plane companies last year came to the amazing sum of \$354,534,000, approximately \$25,000,000 more than the sales of the entire aircraft industry in 1935. Aggregate net profits for the group were \$9,641,000, off slightly from the \$9,555,000 reported in 1935. And this was due largely to cutbacks in the trainer and other light-plane military programs. Current assets came to \$12,058,000 at the 1944 year-end against current liabilities of \$9,560,000. More than \$1,500,000 was added to these companies' reserves, bringing them to a total of \$4,780,000. Their bank debt stood at \$22,500,000, and the net releases due them after the war (or possibly before) amounted to \$4,367,000.

Furthermore, some of these companies (Turn to page 233)

SIDE SLIPS

TRYING to save himself to sleep the other night with a woman engineer, one of the country's top jet engineers came across an illustration of a sac-sinus stage coach carrying round a herd. Suddenly intrigued, he got out his slipstick and, figuring probable costs of horses, oats, hay, stagecoach, depreciation, driver's salaries, and what not, arrived at a two-week cost. Then he figured the ten-week costs of one of the nation's newest jet planes, getting a figure very close to that of the stagecoach.

Next day, at a very important meeting of the country's top jet engineers, he proudly reported his findings. But they were quickly and thoroughly challenged; another engineer said the figures were all wrong because he had neglected to consider the jet effect of the horses.

• The young pilot was looking over a jet job very carefully, running back from the wingtip all he should tell over the engine, which were awaiting instructions. Finally he moved over to the thoroughly fatigued and bearded crew chief and asked, "Say, where does the exhaust come out of this thing?"

The chief was so completely baffled he could only ask, "What did you say—jet?"

"Where does the exhaust, or whatever it is that drives this thing, come out?"

"From the back end of the engines—jet."

"Uh," a pilot, then, "Yeah, but where do they sit?"

Pointing to the engines the chief replied, "Right over there, sir." As the baffled pilot looked out from under the wing he hit his head on one of

the engine attaching fittings, whereupon the chief said quietly, "The engines will go right down, sir, and the exhaust will come out right here."

• Commenting on a new aeronautical publication, a book reviewer speaks of the "Toucan machine"—a gadget we'll certainly have to have. Now if someone will only develop a landing machine outer . . .

• "Wonderful," it seems, is the only word to describe the politeness and his ways of working. New York City's now-shedding (dreadful) airport is proof of there ever was any. The other day we watched concrete being poured for part of one of the 10,000-ft. runways; then we saw a bearded male model showing where all the rest of the runways and other appendages are to go. We also saw an announcement loudly recording the wind directions and velocities. A little whisper brought out the fact that now—after the whole project has been planned and the first of two hundred million taxpayers' bucks have started on their merry way—now they're starting to find out what the weather's like.

• The Nazis discovered what to do with prisoners who no longer could hit the road to sell—and they didn't send them to Berlin to become Iron men, either. But these late war Nazis as bad, as one of our scientific museum men recently found out.

Then Americans and his cohorts spent a very interesting morning questioning a Kuntz who'd been pointed out as a big shot in one of the German secret engine plants. But all they got from him was double talk—very smart, very evasive, but still double talk. Finally they gave up and escorted said Kuntz back to his office where, pointed in large bold letters on the door, was what the American wanted was the title "Diplomatic Expenses."

• With no little fascination, we read in a recent issue of the *Harvard Business Review* a piece on "Topnotch Status of the Aircraft Industry" by William Burdick. In it he refers several times to the "gumball machine"—and we're still wondering if this is a new line of development or if Harvard professors are just congenitally opposed to using the word gas, thinking it an abbreviation.



U. S. Navy's Latest Jolt for Japs—The Grumman Tigercat

Out of a dozen years of experience in building carrier based fighters, and the applied lessons of current combat, has come the Navy's newest fighting airplane—the Grumman Tigercat. In the skilled hands of Marine pilots the new F-7-F will write new pages in the log of carrier warfare.



Grumman
AIRCRAFT ENGINEERING CORPORATION • Bethpage, L. I., N. Y.



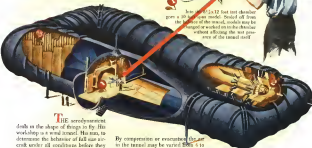
"Wayne's going to build these piston planes right now so mother what he has to do to get underway."

Over 700 miles per hour!

CURTISS WIND TUNNEL SPEEDS DESIGN PROGRESS



A 1/20 scale model of a Curtiss biplane is being tested in the 10 ft x 12 ft test chamber. The model is being tested at a speed of 700 miles per hour. The model is being tested at a speed of 700 miles per hour.



The aerodynamic duct is the shape of things to fly. Its workshop is a wind tunnel. The run, to determine the behavior of full size aircraft under all conditions before they are ever built or flown.

For less Curtiss-Wright constructed within its Buffalo Research Laboratory the largest, constant variable density wind tunnel ever owned by a single aircraft corporation.

By compressing or evacuating the air in the tunnel may be varied from 5 to 60 pounds per square inch to enable tests formerly requiring dense or low tunnels.

Here, with an air duct in human life and with tremendous savings in the time and money involved in building and

test flying full size aeroplanes, Curtiss-Wright speeds the development of aviation that all the world may move quickly and fully share its benefits and honors.



Two 56 blades, 22 foot diameter fans driven by a 14,000 horsepower motor capable of developing 210,000 cubic feet of air through the tunnel test chamber at speeds approaching the velocity of sound.



All wind tunnel operations are controlled from this Console. The motions of the model under test such as Lift, Drag, Pitch, Roll, Yaw, Gustiness and Load Pressure are recorded on dials automatically fed into special IBM tabulating machines. Within 20 minutes these machines and records compare and deliver a mathematical picture of test results that would otherwise require weeks of laboratory human calculations.



Great vortices at the corners of the wind tunnel ducts drive the air around the turns, prevent it from "piling up" at the sides. Here, also, vortices take the heat from the air and keep it up by the tremendous force of many miles towards speed.



AVIATION'S DATA BOOK ENGINEERING

SHEET NUMBER	D-31
CLASSIFICATION	Materials
SUB CLASSIFICATION	Contact Alloys

Properties of Contact Alloys

FOLLOWING PROPERTIES affect either the life or performance of electrical contacts: (1) High melting point, desirable because it reduces susceptibility to degradation and roughening under arcing conditions; (2) High specific heat, giving higher thermal capacity and reducing temperature rise; (3) High thermal conductivity, which permits rapid transmission of heat from contacts to backing material, reducing tendency to coalesce; (4) Low specific heat must exist, giving high electrical conductivity; (5) Low coefficient of expansion in order that contact resistance will not change with temperature increase; (6) Low expansion coefficient, which results in better alignment and maintenance characteristics; (7) Low contact

Alloy	Part used	Specific Gravity	Melting Point	Thermal Conductivity	Coef. Expansion	Ultimate Tensile Strength	Resilience	Specific Heat	Coef. Expansion
			°C	Watts/cm ² at 30 deg. C	Per deg. C	Lb./sq. in.	10 cc. ball 300 lbs. load	Cal./cc. at 30 deg. C	Per deg. C at 30 deg. C
Ag-Pb	0	10.5	960	4.19		20,000	45	1.42	.0006
Pb	100	10.5	327	1.44		30,000	65	1.42	.0010
	20	10.75	2,200	0.95		30,000	65	1.42	.0006
	40	10.85	1,250	0.84		30,000	65	1.42	.0006
	60	10.95	750	0.72		30,000	65	1.42	.0006
	80	11.05	400	0.57		30,000	65	1.42	.0006
	100	11.15	250	0.42		30,000	65	1.42	.0006
	120	11.25	150	0.27		30,000	65	1.42	.0006
	140	11.35	100	0.21		30,000	65	1.42	.0006
Ag-Cu	0	10.5	960	4.19		20,000	45	1.42	.0006
Cu	100	10.5	1,083	3.85		30,000	65	1.42	.0006
	20	10.75	1,020	3.74		30,000	65	1.42	.0006
	40	10.95	750	2.55		30,000	65	1.42	.0006
	60	11.15	510	1.71		30,000	65	1.42	.0006
	80	11.35	300	1.10		30,000	65	1.42	.0006
	100	11.55	200	0.72		30,000	65	1.42	.0006
	120	11.75	150	0.57		30,000	65	1.42	.0006
	140	11.95	100	0.42		30,000	65	1.42	.0006
Ag-Ni	0	10.5	960	4.19		20,000	45	1.42	.0006
Ni	100	11.4	1,450	3.80		30,000	65	1.42	.0006
	20	11.5	1,400	3.70		30,000	65	1.42	.0006
	40	11.6	1,350	3.60		30,000	65	1.42	.0006
	60	11.7	1,300	3.50		30,000	65	1.42	.0006
	80	11.8	1,250	3.40		30,000	65	1.42	.0006
	100	11.9	1,200	3.30		30,000	65	1.42	.0006
Ag-Pd	0	10.5	960	4.19		20,000	45	1.42	.0006
Pd	100	11.4	1,550	3.80		30,000	65	1.42	.0006
	20	11.5	1,500	3.70		30,000	65	1.42	.0006
	40	11.6	1,450	3.60		30,000	65	1.42	.0006
	60	11.7	1,400	3.50		30,000	65	1.42	.0006
	80	11.8	1,350	3.40		30,000	65	1.42	.0006
	100	11.9	1,300	3.30		30,000	65	1.42	.0006

Note: (1) 1 watt per cm. per deg. C = 0.000177 per sq. cm. per in. per sq. per deg. C.

WALDES

EXTERNAL TYPE NAS-51

TRUARC

RETAINING RING



INTERNAL TYPE NAS-50

Waldes Truarc expands or contracts without distortion and without permanent set, fitting tight all around the groove. It offers important advantages over shoulders, nuts, collars, etc., for all thrust-load shims in shaft and housing applications. It saves space, weight, assembly time and machining costs. Waldes Truarc presents a significant advance in retaining rings, well worth your thorough investigation. We will gladly furnish samples and full data for tests, upon request.

Waldes Truarc Retaining Ring Standard 50
Standard Type Retaining Ring Standard 51

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AVIATION'S ENGINEERING DATA BOOK

SHEET NUMBER	D-31 (cont'd)
CLASSIFICATION	Materials
SUB CLASSIFICATION	Contact Alloys

resistance leading to give better performance at high current densities, dependent on kind of material, condition, and shape of surfaces and pressure. (6) hardness and toughness preventing excessive wear, especially when pressure and frequency of operation are present and (7) non-oxidizing, preventing excessive heating of contact surfaces due to resistance of oxide film. Ideal contact material would have high softening point, specific heat, thermal conductivity, hardness, toughness, and wear resistance. It should also have low electrical resistance, temperature coefficient of resistance, contact resistance and coefficient of expansion, no solution

to non-oxidizing properties and low final cost. Important current characteristics in contact selection are: Amount and type of current, frequency of operation, voltage to be interrupted, speed of opening and closing contact pressure, ambient temperature, and atmosphere in which contacts operate. Circuit characteristics—inductive, resistive, or capacitive—should be considered, also methods used for closing contacts, whether gravity, rack-and-pinion, or magnetic. In the field of metallurgy there have been developed new types of contact materials incorporating highly desirable properties and giving greatly improved contact performance.

Alloy	Per cent	Specific Gravity	Melting Point	Thermal Conductivity	Coef. Linear Expansion	Ultimate Tensile Strength	Shear Hardness Vickers	Specific Resistance	Coef. Thermal Expansion
			°K	Watt/cm deg C	Per deg C	lb./sq. in.	10 mm ball 300 kg load	Microhm cm at 20 deg C	Per deg C at 20 deg C
Ag-Pt	0	10.5	900	4.13		29,000 (1)	300	1.62	0.036
	20		1,340	1.04		29,300	65	9.1	0.0317
	30		1,120	1.04		33,300	12	1.1	0.0350
	40		1,140	0.81		33,300	90	29.0	0.0370
	50		1,250			55,000	110	32.0	0.0325
	60		1,250			55,000	140	37.0	0.0330
	70		1,530		0.0014	105,000	170	50.0	0.0340
	80		1,570			125,000	185	54.0	0.0340
	90		1,570			175,000	200	55.0	0.0350
	100		1,570			20,000	170	30.0	0.0355
	100	31.45				30,000	40	31.0	0.036
Pt-Ir	0	21.45	1,730	0.490		69,000 (2)			
	5	21.45	1,730	0.490	0.00006	300,000	170 (2)	37.0 (2)	0.036 (2)
	10	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	20	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	30	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	40	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	50	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	60	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	70	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	80	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	90	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
	100	21.45	1,730	0.490	0.00006	300,000	220	37.0	0.036
Pt-Co	0	12.0	1,550			70,000	40	11.0	
	10	12.0	1,550			70,000	40	11.0	
	20	12.0	1,550			70,000	40	11.0	
	30	12.0	1,550			70,000	40	11.0	
	40	12.0	1,550			70,000	40	11.0	
	50	12.0	1,550			70,000	40	11.0	
	60	12.0	1,550			70,000	40	11.0	
	70	12.0	1,550			70,000	40	11.0	
	80	12.0	1,550			70,000	40	11.0	
	90	12.0	1,550			70,000	40	11.0	
	100	12.0	1,550			70,000	40	11.0	

Notes: (1) 1 watt per sq. cm. per deg. C. = 0.239 cal. per sq. cm. per deg. C. (2) work hardened (3) quenched from 600 deg. C.

(Continued on Page 31)



COAST GUARD'S HYDRAULIC Rescue Hoist

... engineered and built by **VICKERS**



This Sikorsky Helicopter equipped with a Vickers Hydraulic Rescue Hoist is used for rescuing personnel from the water or any other inaccessible place. Here is an application that well illustrates many of the important advantages of Vickers Hydraulic Power and Control.

The Vickers hydraulic motor for driving the hoist has the high starting torque necessary. It will hold without slippage or backset and can be stalled indefinitely without damage. It has easily controllable variable speed and smooth operation. It has instant starting, stopping or reversal due to very low inertia of the moving parts. It has simplicity of design and installation. It is rugged and dependable yet has minimum weight. These are all characteristic features currently useful on many other aircraft applications.



VICKERS AIRCRAFT POWER TYPE HYDRAULIC PUMP AND MOTOR are the heart of the Hydraulic Rescue Hoist. Their overall efficiency and horsepower/weight ratio are exceptionally high; they occupy little space. A wide range of models is available.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

AVIATION'S SKETCHBOOK OF

DESIGN DETAIL

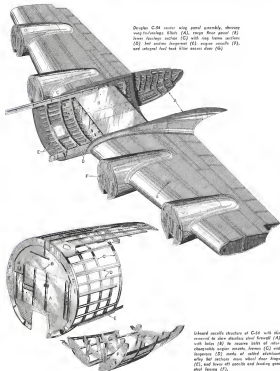


Diagram C-54 engine wing panel assembly, showing wing-to-fuselage fillets (A), wing floor panel (B), lower fuselage section (C) with wing fitting section (D), fuel system component (E), engine nacelle (F), and integral fuel tank filler access door (H).

Isolated nacelle structure of C-54 with the removed to show structure of wing (A) with fillet (B) to secure inlet of air-chambered engine nacelle, fuselage (C) and inspection (D) marks of solid structure wing that includes main wheel drive frame (E), and lower air nacelle and landing gear door fitting (F).

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**Originals...
 -EVERY ONE...
 INCLUDING THE
 PREFORMED ROPE**

• American Chain & Cable originated and patented TRU-LOC fittings as well as the pre-formed rope on which they are swaged.

Through constant experiment we have found ways to improve tru-loc fittings. Through constant test we make sure that highest safety standards are maintained.

Because of our long experience in the design, production and use of swaged fittings and our intimate contact with aircraft manufacturers, we are often able to be of help with engineering problems. We welcome such opportunities.

For information about controls, fittings or aircraft cable, write our Detroit office.

TRU·LOC
Swaged terminals & fittings



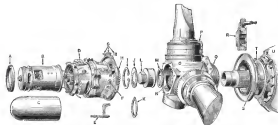
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**AUTOMOTIVE AND AIRCRAFT DIVISION
 AMERICAN CHAIN & CABLE**

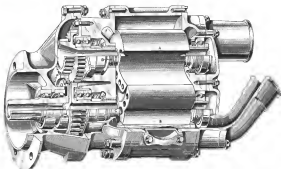
TRADE
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The Answer for Your Safety



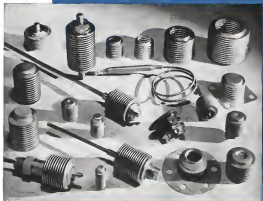
Exploded view of Roto electric constant speed propeller showing motor retaining nut (A), electric motor (B), motor frame (C), reduction gear (D), driving housing (E), driving level gear (F), clutch (G), holding plate (H), ac-

toruator ring (I), hub retaining nut (J), cone (K), motor level (L), propeller hub (M), driver gear (N), slippers (O), bush gear (P), slinger ring feed gear (Q), slinger housing (R), and final reduction gear (S). The reduction gear housing installation is shown at (U).



Adjust valve (R) is designed to maintain pressure constant at 30-3500 ft up to altitude of 40,000 ft. Rotor-driven supercharger is of the displacement type with two rotors (A) and (B) intermeshing and not touching each other when in rotating or idling position (which would assemble interference) can be altered with

shims. Since however, rotors (C) and (D) and the gear train must be lubricated, pumping chamber is sealed off by conical spacer and no oil leak through ports such as at (F) to create "one way traffic of oil" and thus prevent dropping out of oil all. Numerous other details of unit's structure may be noted in the cutaway.



HERE MAY BE YOUR ANSWER...

...or here

SOMETIMES, it isn't heavy to get done, we suggest the shortest way here.

For example—the solution to many bottlenecks in temperature regulation may be found in the photograph above... at this message itself may suggest an answer to your problem.

Fulton Syphon thermostats and bellows assemblies are the basis of controls used in every industry. They regulate oil,

water, and air temperature, they function in engines on land, sea and in the sky, they do an amazing number of jobs in manufacturing plants, institutions, homes. Automatic in operation, they eliminate countless manual tasks.

Fulton Syphon engineers will work with you, help find the most effective and economical answer to your problem.

NEW MOVIE—The Story of a Bellows is available in extended groups. Shows and shows round. Tells all about bellows, how they're made, what they do, how they do it.



Catalog TC-1908 tells all about Fulton Syphon bellows and bellows assemblies. Write for it.

FULTON SYLPHON

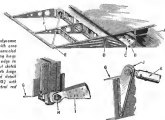
TEMPERATURE CONTROLS

BELLOWS — BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

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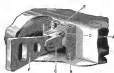
Aluminum of the Jet Ship Fighter is of monoplanes bellows type, attached to rear spar (A) with cone (B) designed to give bellows edge (C) an attached operation. Allowance given at (D) is located along hinge line. (E) shows gear for attaching tracking edge in oil and typical side arm shown at (F). Detail detail (left in group) shows oilpan type of (G) with hinge fitting at (H) and wing fitting at (I). And detail sketch (right in group) shows oilpan type (J) with attachment fitted to oilpan at (K) and control rod hub at (L).



Carburetor of Otter wing control section on which bellows meets along side (A). Rear center and front spars are shown at (B), (C) and (D) respectively. Nuts T-nutted (E) and angle (F) which instead of being straight along top surface following wing are formed at an arc with only one part

coupled to the. Similar arc shape can be seen on spars was rolled straight along top surface, differing from those left of rear spar which follow conventional pattern. Allow oil pan for oil pan (lower edge indicated by dotted line) is located at (G).

Detail of Otter elevator hinge assembly, with elevator spar shown at (A) and hinge fitting (B) side which hinge support (C) is linked by through-bolt (D). Complete fitting is attached by bolt (E). Wings fitting from stabilizer is at (F).



AIRCRAFT INSTRUMENTS

by GENERAL ELECTRIC



Remote-indicating Temperature Equipment

On present-day aircraft, two basic systems of temperature indication are widely used. They are the ratio-type, which is used for the indication of oil temperature, carburetor-air temperature, and outside-air temperature, and the thermocouple-type, which is used for the measurement of exhaust-gas temperature and for other special applications.

Although the required range of each of these indications is different, the construction of these G-E instruments is such, even to the extent of generating names of functions from the scaleplates, that a single design can often be used for various purposes. However, when special requirements are encountered, G-E engineers will be glad to work with you on the specific problem. When our facilities are no longer needed for war, we will continue to build many designs of aircraft instruments to meet your needs. General Electric Company, Birmingham 8, N. Y.

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Pressure-indicating equipment
Tachometers and speedometers
Liquid-level-indicating equipment
Remote-indicating compasses
Electric gyroscopes

FOR BETTER DESIGN

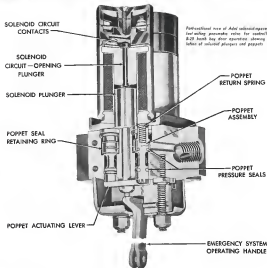
How Pneumatic Valve Solved Split-Second Bomb Door Operation

USED TO CONTROL the operation of the bomb-bay doors, the Adel Pneumatic Products Corp.'s fast-acting solenoid-operated pneumatic valve is instrumental in making 3-25% more efficient contributors to safety of plane

and crew, and saves substantial dead weight on these giant loadbars.

The longer it takes to open bomb bay doors, the more time is allowed enemy anti-aircraft gun crews to calculate range, adjust automatic gun

directions, and open fire on the bombers. If the enemy gunners are aware that a bomber is on its target run, they know the pilot cannot resort to diversion tactics in an attempt to confuse their aim. Accordingly, they watch for the



Functional view of Adel solenoid-operated fast-acting pneumatic valve for controlling B-29 bomb bay door operation showing motion of solenoid plunger and poppet.



HOW ALUMINUM BRAZING RAISES SAFE TEMPERATURE-PRESSURE LIMITS OF HEAT EXCHANGERS

Until recently the temperatures and pressures which aircraft oil coolers and coolant radiators could withstand were limited by the annealing property of copper and the low melting point of the soft solder used to bond the tubes to shells and header plates.

Clifford's twenty discovery of the method of brazing aluminum in this modern modified design of several types of USAAF aircraft to meet temperature-pressure requirements, while saving 3½ the weight of the replaced copper units. That was because:

1. Heat treatable aluminum tubes withstand working temperatures up to 225° F.
2. Heat treatable aluminum plates, shells and other parts stand up under temperatures and pressures that far exceed the failure point of other metals commonly used in aircraft oil coolers and coolant radiators.
3. High temperature aluminum alloy bonding material holds securely at temperatures several times higher than the joint where soft solder fails.

WHAT CAN ALUMINUM BRAZING DO FOR YOU?

Clifford's patented aluminum brazing method is still restricted to oil coolers and coolant radiators for USAAF fighting planes; but its potential use in the manufacture of heat transfer units for automotive, marine, cooling and ventilating applications is now being considered. Your inquiry is invited. Clifford Feather-Weights see 3½ the weight same size and shape.



SYNCHRONIZING MOTION WITH BAROMETRIC CHANGES ACCURATELY

Today, several or evacuated bellows assemblies are being widely used for automatic translation of changes in altitude or vacuum into motion required to operate valves and switches — to compensate for the effect of pressure changes on instruments and controls.

Typical applications are altimeters, oxygen-air mixture controls, absolute pressure recording and controlling instruments, booster relief valves, supercharger boost controls, fuel and manifold pressure gauges, turbo-supercharger controls.

The spring rate of the bellows at the heart of each assembly is only as accurate as the wall thickness of the bellows. Since accurate wall thickness is inherent in the hydraulic method of forming bellows — pioneered by Clifford — accurately-calibrated, hermetically-sealed, nearly-indestructible Evacuated Bellows Assemblies are usually first choice. Given the total amount of travel (with allowable tolerances) Clifford will design, assemble, evacuate, seal and test the one right evacuated bellows assembly for you. Subject sketches and data before design are too far advanced.

First with the Facts
on Hydraulically-Formed Bellows

CLIFFORD MANUFACTURING COMPANY
301 S. First Street, Boston 27, Massachusetts

OIL COOLERS AND COOLANT RADIATORS
HYDRAULICALLY-FORMED BELLOWES



boom-bay doors to open—a sign that the leader is on target run, maintaining a steady course at constant speed or several seconds at least. In the past, the loss of many craft has been attributed to slowly opening doors which lengthened the target run.

Original D-24 required as much as 20 sec. or more for opening the bomb compartment doors. Even when pilots tried to reduce the search's advantage by delaying the opening of the doors until the last moment, still too much time was allowed for enemy guns to become effective. It became acutism, therefore, to contract the reaction by providing means whereby the time interval required for opening the doors would be greatly reduced.

The ATSC considered Boeing engineers to resolve the problem, and various methods for moving the doors were studied to determine a system that would do the job in a split second. Calculations and preliminary tests showed that a pneumatic system offered encouraging possibilities, provided that a control valve, among other items of special equipment, could be designed to operate the valves fast enough and yet possess the required degree of dependability.

After thorough studies determined the feasibility of using compressed air to operate the system, field engineers were presented with the problem. Engineering studies made preparatory to the experimental design program called for adapting an already constructed valve based on the previous design of a similar controlled high pressure fluid valve already in production.

Believed-actuated valves of this type are normally operated by a low voltage current to the solenoid or in the event of electrical system failure may be manually operated by cables connected to the emergency handle. Being connected to the control point by small cables or wires, solenoid-operated valves may be placed close to associated related equipment.

Performance tests on the experimental valves revealed by a wide margin the conditions to be met in actual service. One of the tests provided of testing the valve assemblies in an area for seven days continuously at a temperature of 160 deg. F. while subjecting them to various opening conditions, using air pressure at 675 psi—greatly in excess of the system pressure in service (175 psi). Pressure drop through the valve was measured against variations in volume of air passing through it, and was found to be within satisfactory limits.

Operating the emergency handle, torque loads were measured with the

valve controlling air pressure up to 450 psi, the load being 85 in. lb. at normal temperatures and 225 in. lb. with temperatures lowered to -53 deg. F. Both values indicated an opening load considerably under specified maximum allowable.

Electrical tests were made to determine current consumption and minimum voltage required to operate the valve in 1/18 sec. when controlling the air at 450 psi. Required wire it was at 118 v. to actuate the solenoid and upon the valve, and 0.25 amp. to hold it—indicating a very small current consumption, especially in view of the wide difference between the test pressure (450 psi) and actual system pressure (175 psi.).

The valves were also subjected to a life test consisting of on-and-off operation 60 times per min. for 25,000 cycles. Air flow was maintained at 6 cfm. at 450 psi test pressure, and no leakage was evident at any time. All moving parts, when checked at the close of the run, were well within allowable dimensional tolerances, showing little or no wear. No malfunctioning was caused by 58 hr. of vibration at frequencies of 50 to 3,200 cycles per min. at ½ in. amplitude.

Cold tests made over a period of 72 hr. at various temperature levels—lowest being -52 deg. F.—had no detrimental effect on the valves, which were operated continuously under maximum test pressure.

Reducing the air at 450 psi presented a problem in design, necessitating a

departure from methods usually employed with valves for hydraulic fluid, and the assembly was fixed in the form of a poppet incorporating "O" ring seals.

The change-over from the original constant-on boom-bay door system to pneumatic actuation resulted in a weight-saving of 300 lb.—the equivalent of more than 35 gal. of fuel. Action of the doors was stopped as they would, closed and fully open in less than 1/10 sec., whereas former electrical assemblies required over 20 sec. Closing the doors originally required 30 sec., while with the new installation they are closed and latched in 1/25 sec.

The door actuating system consists of an electrically driven air compressor specifically built for aircraft applications, reservoir for storing a sufficient volume of compressed air to move the doors through four cycles of operation; manually controlled valve for each pair of double-acting actuating cylinders; pressure door latches on air receiving valve for maintaining system pressure at 175 psi.; and micro-switches through electrical circuit devices.

Each solenoid in the valve is double wound. Both coils being connected in parallel and producing an electric magnetic force of sufficient magnitude to snap the plunger into restricted position in a fraction of a second. Moving up, the plunger uncovers a pair of poppets and breaks the current in one of the solenoid coils, leaving only the

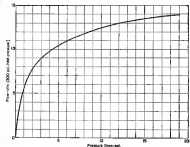


Chart of pressure drop plotted against air flow through pressure control valves.



RIGHT
from the
START!

You'll find WHITAKER is a dependable source —if your production needs include CABLE ASSEMBLIES

Let specialists who are experts produce the cable assemblies, wiring harnesses or bonding jumpers required in units you manufacture. Turn the job over to Whitaker —and it will be right from the start.

Throughout every stage of our production we make exacting inspections, tests and checks. (Illustration shows positive continuity check of assemblies being made for an electronic manufacturer).

Whitaker Can Wire It

In addition to an engineered wiring service, Whitaker also offers a quality line of standard cable requirements . . . Write us for complete information.

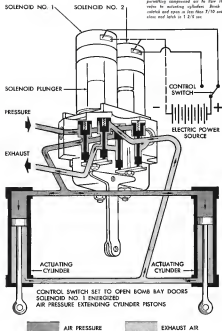
WHITAKER CABLE CORPORATION

General Offices: 1361 Burlington Avenue, Kansas City 18, Missouri
Pasterior: Kansas City, Mo. • St. Joseph, Mo. • Philadelphia • Oakland

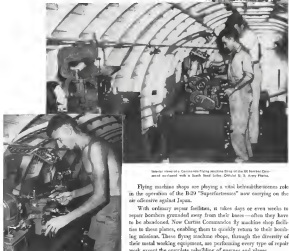
holding coil energized, which is enough to hold the plungers against the compression of the two poppet springs. Unseating the poppets allows compressed air to flow through the valve to the actuating cylinders in open or close the bow bay doors, depending upon the position of the control switch

connecting one or the other solenoid to the battery circuit. Initial current demand of 12 amp. at 36 v. is only momentary, and is reduced to 8.20 amp. necessary to hold in the plungers after one of the two coils is cut out immediately upon retraction of the plungers.

Schematic view of pneumatic valve. Electro-magnets force air solenoid coils when plungers retracting in location of second, unseating poppets leveling control in one of coils to allow holding coil to return plungers against compression of poppet springs, and permitting compressed air to flow through valve to actuating cylinders. Stroke shown retracted and open in less than 1/10 sec., and close and latch in 1-2/10 sec.



A black and white photograph of a biplane on a runway. A person is standing next to the plane, and there are mountains in the background.



Special Agent in Charge Flying Machine String of the BB Number One
group is paired with a Super Seed Index. Official S. S. Army Florida.

With ordinary repair facilities, it takes days or even weeks to repair bombers grounded away from their bases—often they have to be abandoned. Now Curtiss Commanders fly machine shop facilities to these places, enabling them to quickly return to their bombing missions. These flying machine shops, through the diversity of their metal working equipment, are performing every type of repair work except the complete rebuilding of engines and planes.

The unprecedented job being done by these flying machine shops is bolstering our striking power where it is needed the most. As an important part of this equipment, South Bend Lathes are contributing their dependability, accuracy, and versatility.

```

... Government now sailing off on output controls
... AASB faces big job ... June output: £714
planes ... Next month—deregulation ... "Keep the
factious" says IBE ... ATSC being revamped ...
Talk foreign-carrier needs.

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The revision is an amendment to Executive AD 4 which

weight to "Admiralty No. 1," which was recommended by the Production Management Committee of WFO and which is the exclusive instrument at the Office of War Mobilization & Reconversion. The Committee re-

jects it they seem, however, because average softness weight is constantly increasing from 4,000 lb. in 1944 to an expected 16,000 lb. next year.

The Air Force Chief and the rest of the panel seemed to be in agreement that the Panel report had been prepared. He said that a large proportion of the funds available for the aircraft, and he believed that the aircraft would be spent on guided missiles. The Army, he continued, wants to maintain the government-owned aircraft plants in the United States and to have the aircraft at them built in the United States.

**Government Buying Off
On Budget Controls**

Indefinite are that the government is about to withdraw its controls over the reduction of alcohol, and that it will not take a substantial interest in reconstruction of the industry to permit production. Top WPA executives are considering early folding of the Bureau almost definitely.

Professors of light planes ready have the go-ahead on routine orders, together with "spot" maintenance, as and when materials and manpower are available over and above war work. Transport type planes are being built for the airlines with electric engines.

It will not be merely warlike products of both types. It will be on their own. And, as it can be learned, the government has no unusual plan for aiding conversion to

ALFA Focus Big Job
The time is drawing near when the ALFA Airlines subsidiary of Aeroflot (the Russian Airline Co.) will resume its function as the representative and spokesman of a competitive group of airplane industries in the Soviet Union. The airline will be a masculine presence in the Soviet market.

In the following breakdown of the June output, the East Spur falls compliances while the second trace quotes the opposite: **Revenue** 1,144, 2,877; **Customs and Narcotics** 9,779.

Adams 2, available first to be sold to the U.S. public against automotive and rail competition, and a world market for airplanes must be satisfied.

Next Month—Aurora

John W. Friedlander, president of AIAAA, has announced that his company will be producing division magazines before Labor Day starts output, he states, is already underway for the craft, without affecting researching activities work.

June Output: 5,794 Planes
Though the June schedule called for production of 6,000 aircraft, the output actually

The company has been negotiating with the Defense Plant Corp. for rights to operate the TPC facilities at the Avoncon, Middletown, Ohio, plant. Agts said no military work has been awarded, giving space for the "irrelevant manufacturing."

BFA Chaptering Review

Powerful support for anti-terrorism aviation research and military production is given by the National Financing Act's advisory committee on the aircraft industry.



Call Your Top Talent

Larger than any other flying boat ever built is Hughes Aircraft Co.'s all-wood Pegasus, shown here in final stages of construction at Culver City, Calif., plant. With its striking span of 320 ft. and nose tail at 220 ft. long, 30 ft. high, and 29 ft. wide, Pegasus is to be powered by eight PW5-Weng Main engines of over 2,000 hp each, which would give Pegasus an estimated 225 mph. by speed, 1,700 mph. cruising speed, and a 3,500 mi. range with 125-mi. payload. Pegasus has 100 seats for short-haul; capacity for 200 for longer or 700 freighted payload may be desired. Several models are being developed with advanced project following earlier withdrawal of Pegasus.

Write For
NEW LATHÉ CATALOG
Colors of South Bend Eagle
Lathes, Toolroom Lathes, and
Precision Turret Lathes in de-
tails. Ask for Catalog 207.



SOUTH BEND LATHE WORKS

Lethe Builders for 20 Years
502 EAST MADISON STREET SOUTH BEND 32, INDIANA

REPEAT PERFORMANCE

On planes after planes, "flying men" line up beside "swastikas" on the men and planes that helped crush the Nazis join the fight against the Japs. ★ Strategic air the island-dotted open seas to the pilots who earned their "swastikas" over the hedgerows and winding rivers of the European Continent.

★ As familiar as the voice of an old friend is the smooth-running power of their Allison engines. Pilots learned half a world away that the name Allison means quality workmanship—and a reliable, dependable product.

KEEP AMERICAN STYLING
OUT HERE AND THERE

POWERED BY ALLISON

P-47—Curtis
P-51—Allison
P-40—Allison
P-38—Allison
P-43—Allison
P-44—Allison

More than 1,000 Allison engines have been built for the armed forces of the U. S. Army Air Corps.

LIQUID-COOLED AIRCRAFT ENGINES

Allison

DIVISION OF



Warren, Michigan, U.S.A.

Every Sunday Afternoon—General Motors Stations—VH-TV ABC—NBC National

★ report by the Association recommends that "The production of industrial development should not be allowed to collapse while our long-term policies for industrial development are being established."

NPA is a non-partisan, non-political organization whose studies and reports carry considerable weight with Congress and executive officials at the government.

"The future of this industry," NPA adds, "especially relies upon the development of an essential nucleus of research, engineering, labor, and management talent." A national fund, industry, labor, and international cooperation of NPA members in the industry favoring prompt planning to insure the research program.

"Save the Yawful"—SPR. Remember that all tactical airplanes in surplus inventory are subject to scrap. The Douglas fleet has been reduced to 100,000 units, and only 40 have been delivered. After the war of course some of the surplus fleet will be sold to other countries and some will be sold to the Navy. The Douglas fleet will be sold to the Navy. The Douglas fleet will be sold to the Navy.

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DAFTER FOR CARDS OF CASUALTIES

First National Bank of New York City has been selected to handle the distribution of cards of casualties.

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★ FOR THE RECORD ★

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★ ASSEMBLY LINES ★

General Motors Corp. has announced that it will be producing 100,000 units of the new GM Corp. car.

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★ CALLING NAMES ★

(Continued from page 12)

(Continued from page 12)



A Ship of War—With a Peacetime Destiny

You won't have to beat this weapon of war into a peacetime plowshare. VJ Day will see the Fairchild-designed "Puck" ready to play the seriousness of commerce.

Built specifically for military cargo—tons of guns, men and equipment for battle—the "Puck" ("Puck" has) will receive the bulky goods of peacetime commerce with ease, speed them hundreds or thousands of miles to their destinations.

Designated by the Army as the C-42, the "Puck" has been nicknamed the "flying house." Its cargo compartment (2,670 cubic feet of unobstructed and continuous space) carries 93% of the capacity of a railroad boxcar.

Facility in loading is a triumph of Fairchild design. Split doors at the rear of the fuselage open to the full width of the cargo space. Cargo can smoothly into the "Puck" from a truck, for the "Puck" ("Puck") horizontal floor is at standard truck floor height. Smaller pieces can be loaded through a forward loading door.

The value of the "Puck," to shippers of all types of "typical" cargo, will be as broad as the future of its cargo itself. Tons and experience will attest to its economy and multiplicity of uses. Then, the "Puck," new at war, unphases the Fairchild tradition of advanced aviation, "the touch of tomorrow in the planes of today."

ENT BY S. WAR BOND AND STAMPS

Fairchild Aircraft

Divisions of Fairchild Engine & Airplane Corporation, Rye, New York

used aircraft inventories. After contracts are received, C-42s will build a series of warehouses with significant business groups.

A new part of covering non-activated readiness is at present being circulated (see story on page 36 of July Aviation).

* CARGO COUNTRY *

ATA predicts that the 1945 production will be about 10,000 units, compared with 1944 production of 10,000 units. ATA predicts that the 1945 production will be about 10,000 units, compared with 1944 production of 10,000 units. ATA predicts that the 1945 production will be about 10,000 units, compared with 1944 production of 10,000 units.

ATA carried out commercial cargo from S. C. to the West Coast. ATA carried out commercial cargo from S. C. to the West Coast. ATA carried out commercial cargo from S. C. to the West Coast.

New production in April 1945. ATA carried out commercial cargo from S. C. to the West Coast. ATA carried out commercial cargo from S. C. to the West Coast. ATA carried out commercial cargo from S. C. to the West Coast.



ATA NEW TYPE BENDING ATA carried out commercial cargo from S. C. to the West Coast. ATA carried out commercial cargo from S. C. to the West Coast. ATA carried out commercial cargo from S. C. to the West Coast.

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FOR EASIER FABRICATION AND LOWER COSTS—

Carpenter STAINLESS TUBING

- * You save 15% to 40% with this type of tubing.
- * Uniform walls permit easier fabrication, lower rejects.
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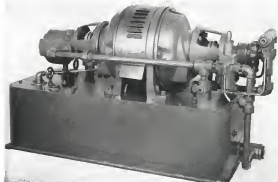
You get all these advantages, plus the design freedom you expect from Stainless Steel... strength with light weight, economy and best resistance.

When you want the advantages of Stainless Tubing—as at a saving for the Carpenter. We'll be glad to put our detailed experience to work on your engineering and fabricating problems. And, especially, of the Carpenter Stainless Tubing. It means fabrication on every type and fabricate available, and detailed engineering data. A note on your company booklet will bring it to you.



THE CARPENTER STEEL CO.
United States Steel Division
Pittsburgh, New Jersey

Carpenter WELDED STAINLESS TUBING



HYDRAULIC POWER UNITS • 3000 P. S. I.

Packaged Assemblies Combining High Pressure Low Volume and Low Pressure High Volume Pumps and Valves for Manual and Automatic Control

PRESSES • CALENDER ROLLS • HYDROSTATIC TESTS • ROLL BALANCING
BROACHES • PRESSURE SEALS • FLOW TESTS • BEARING FLOTATION

Hy-Lo Hydraulic Unit

21 GPM • 3000 P. S. I.

These units have been in extended service in Rolling Mills
• Textile Plants • Chemical Plants • Plastic Plants • Tanning
Laboratories • Research Laboratories • Rubber Plants • Powdered
Metal Industry • Aviation Research • Airplane Manufacture
for Standard Equipment and Production Test Procedure

3000 P. S. I. Pumps in Capacities of 1/2- 1- 2- 3 GPM • Hy-Lo Combinations 5 GPM and Up

Experienced Hydraulic Engineers Are Available Without Obligation

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Hydraulic Division

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Falkland Owners & Investors Corp. reports 1946 net earnings of \$140,074 or \$1.96 a share compared with \$1,223.91 or \$1.65 a share in 1945. The company was valued at \$1,000,000 at a \$100,000 par value, which is at a 10% discount to par value.

Franklin Electric reports net assets of \$2,432,000 or \$1.25 a share for three months ended Mar. 31. While it is in arrears, according to First City Corp. dividends are restricted to 10% of a share's value. Sales in 1946 were \$1,500,000 against \$1,000,000 in 1945.

First American Airways Corp. has filed a registration statement with SEC for 2,000,000 new common shares valued at \$200,000. The company is now doing a study of the market for the stock. The company is now doing a study of the market for the stock. The company is now doing a study of the market for the stock.

General Electric Corp. has filed a registration statement with SEC for 2,000,000 new common shares valued at \$200,000. The company is now doing a study of the market for the stock. The company is now doing a study of the market for the stock. The company is now doing a study of the market for the stock.

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AVIATION FINANCE

Merger Developments Highlight Finance Front

Stock-Exchange listings of firms involved in Aviation Finance Front

After merging plans for a merger into consideration, the firm's stock is now listed on the New York Stock Exchange. The firm's stock is now listed on the New York Stock Exchange. The firm's stock is now listed on the New York Stock Exchange.

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TYPE WWD—an adjustable worm drive hose clamp made of stainless steel and designed to make full advantage of the superior physical properties of this material. Note the compact streamlined housing... the hard-ened one-piece thrust-rod—PLUS a new exclusive Wittek feature—an inner band of Stainless Steel accomplishing the two-fold purpose, (1) protecting the hose from the stresses in the outer band, and (2) distributing the load uniformly to provide greater strength and superior sealing characteristics.

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WILLIAM C. KENNEDY has been named vice president and general mgr. of Wright Aero Corp. He is also vice-pres. and mgr. of Wright's Commercial plant. He is a graduate of West Point and a member of the National Aeronautics Association.



GEORGE H. WOODRUFF, mgr. of Westborough Aviation Corp. Technical Director of the company's Dept. of Aircraft Development, is a member of the National Aeronautics Association.



C. B. SMITH (left) was named chairman of board of A.A. A. and president of the board. He served as president of the board of A.A. A. from 1938 to 1942, and as president of the board of A.A. A. from 1942 to 1946. He is a member of the National Aeronautics Association.



COL. RICHARD P. JOHNSON (right) was named chairman of board of A.A. A. and president of the board. He served as president of the board of A.A. A. from 1938 to 1942, and as president of the board of A.A. A. from 1942 to 1946. He is a member of the National Aeronautics Association.



PEYTON M. HARGRAVES (left) was named chairman of board of A.A. A. and president of the board. He served as president of the board of A.A. A. from 1938 to 1942, and as president of the board of A.A. A. from 1942 to 1946. He is a member of the National Aeronautics Association.



WILLIAM W. BRADLEY has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.



LT. COL. GEORGE T. COX has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.



THANE C. MORDAHL, head of operations of A.A. A. and president of the board. He served as president of the board of A.A. A. from 1938 to 1942, and as president of the board of A.A. A. from 1942 to 1946. He is a member of the National Aeronautics Association.



WILLIAM E. AMUNDSON has been named chairman of board of A.A. A. and president of the board. He served as president of the board of A.A. A. from 1938 to 1942, and as president of the board of A.A. A. from 1942 to 1946. He is a member of the National Aeronautics Association.



PEYTON M. HARGRAVES (left) was named chairman of board of A.A. A. and president of the board. He served as president of the board of A.A. A. from 1938 to 1942, and as president of the board of A.A. A. from 1942 to 1946. He is a member of the National Aeronautics Association.



ERIK RUDE has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.



DONALD S. RUSSELL has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.



WILLIAM J. BRIEN has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.



LOGAN RHODES has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.



JOHN L. HOLLIMAN has been named chief of operations for new South American airline, TACA. He is a member of the National Aeronautics Association.

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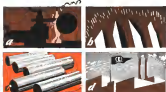


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Products and Practices

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

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crystalline. Analyzed with IR (KBr) but compared with pure NaCN and was found to be identical on analysis of both ways. Solubility: insoluble in water, methanol, benzene, but soluble in DMSO. It is a strong oxidant. Aqueous solution is known to consist of cyanide ions, cyanogen, dicyanide, and cyanate ions. Cyanogen is the main product of thermal decomposition. Anal. Calcd. for $\text{Na}_2\text{C}_2\text{N}_2$: C, 40.0%; N, 60.0%. Found: C, 39.5%; N, 59.5%.

Vertical Brushing Machine..... 44



along and within water up with an dry
single ground near reaching head of branch
No foliage or attachments are used
Remains is covered through and returns
faintly visible (1) in depth (1) in
width (1) in (1) in (1) in (1) in (1) in
—MAY 1968, p. 46

Automatic Toggle Press.....4
 Features of automatic toggle press No. 100, manufactured by E. W. Allen Co. (Boston) is that automatic feeding is provided to handle the full range of sizes of workpieces—ranging from 1/2" to 1 1/2" diameter—without the need of changing the die from full size to holding the die for drawing operation. Call size is fed through a feed mechanism of which characteristics is a positive simple feed, and a short time reverse counter. A standard 1000 sized is attached to foot pump, which is furnished with air in-



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automatically. Whichever wheel the load is turned, roller wheel (No. 2) will have pressure ground against skidless wheels of truck and thus maintain evenness of load. **AVIATION, Auto, No.**

Soldering Stand71
Steel and brass stand of Model 8000 soldering stand, manufactured by Ben Beverly 6410, Des Moines, Ia. 50310



adjustable to permit use of pen, torch, or soldering iron. Stand provides pressure and hold lines of soldering wheel. **Ben Beverly, Des Moines, Iowa. AVIATION, Auto, No.**

Air Vise28
Simplified assembly for building practically any irregular shaped part within 10 minutes, can be used on lathe tool by Lombard Machine Co., Los Angeles.



is shown to be particularly adaptable for production work of light machine or lathe, also for grinding of many new metal parts. **AVIATION, Auto, No.**

Tool User's Dictionary73
Press Bros. Gear & Machine Corp., Chicago, has issued two books entitled "Tool User's Dictionary" and "Tool User's Dictionary" which deal operation of tools. Primary reference is provided by a 120 page booklet which contains 1000 illustrations and 1000 definitions of tools. Each volume has a list of 1000 definitions of tools. **Press Bros. Gear & Machine Corp., Chicago, Ill.**



both is equipped by hand rollers and large size is intended for heavy work. **Devco Tool Co., 1000 E. 1st St., St. Paul, Minn. 55101. AVIATION, Auto, No.**

Welding of Jet Engines74
Protecting weld metal that withstands great temperatures and stresses is the goal in jet propulsion systems, now manufactured by General Motors. **General Motors, Detroit, Mich. AVIATION, Auto, No.**

Building Gunner Camper75
Larkfield Gun, Dayton, Ohio, presents building manual for gunner's camper.



Larkfield Gun, Dayton, Ohio, presents building manual for gunner's camper.



Reconnaissance Flyers Wear RAY-BANS....

Following the course of their sweeping flights over Japanese-held islands, some marine aerial photographers wear two glasses to protect their eyes against burning Japanese sun. Lenses from hundreds of such flyers and the most well known of them, Ray-Ban, are the most common of them. Ray-Ban Sun Glasses are to be seen during today. In use on every flying front today, protect Ray-Ban lenses and frames effectively about the glass-producing rays, yield sharp, clear, comfortable vision in brightest sun. **Ray-Ban & Lens Optical Co., Rochester 2, New York.**

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work, which would have required 1,800 men—if he could have obtained them, along with enough machinery to keep them busy. In another area, a crop-pick was delayed by caterpillars. Ground spraying was too slow and necessitated the collection of the poison during the hottest part of the year when the farmers of the area were in greatest demand. The grove in question was 800 ft long and 325 ft wide. At any rate, the actual dusting time was 54 seconds in the early morning before people filled the park. Research was that 99 percent of the insects were killed and the grove was saved.

Another advantage possessed only by the airplane is that dusting operations in large crop areas can be spotted from the air while they are well under way, and before sufficient damage has been done to permit observation from the sides of the field.

In the Philippines, locust travel has been found effective only when the airplane was used. By dusting around the insects on the early morning, before they commenced flying and then dusting in front of them while in flight, it was found that entire swarms of locusts could be destroyed. Previously, the only effective method was to shoot a row of fire, which frequently did as much damage as the insects.

As a business, crop dusting (and other uses of the plane in farming) can be made to pay a good profit. Across the borderland of "Red" Fresno, in Sacramento, Cal., there is the business, "Crop Dusting—Fire, Phrasing—Liquid Spraying—Fertilizing—Weed Control, Wet or Dry." And below that is the line, "James Coop Dusters . . . Since 1937." When a man has stayed in the same business at the same place for 15 yrs, he has not only made it a success, but he knows well what he is doing.

In another part of his letter James says, "Average cost of application is from 4¢ to 5¢ per bu., but within the past eight months there has been an influx of inexperienced operators who have forced the price down to 2½¢ per bu., causing big experienced and established dusters either to compete at a loss or close their equipment."

The foregoing statement should be measured by anyone who hopefully contemplates using crop dusting as a means of getting rich quickly. A man of little or no experience—regardless of how good a pilot he may be—needs to learn a lot before he starts in this business. After he has learned what to do and how to do it, he has learned that there is no money in working at a loss. In fact, the more business he obtains in this way, the sooner he will be out of business. Unfortunately, in every branch of industry

there are a temporary few who seem never to learn hard of this fact.

Beginning experience in dusting should not be difficult for the pilot who has logged sufficient hours to give him expert flying skills. Many of the larger dusting operators are willing to teach new men with these qualifications. H. A. Paulin, of Central Airport, Yakima, Wash., states, "I need good pilots. I will teach them how to apply dusts and liquids, give them a course in elementary meteorology, and pay a good salary. By the end of a year they should have sufficient experience."

Area which can be covered per hour is extremely variable. Open fields permitting long runs can be dusted at a rate of 400-600 acres per hour, while vineyards "harmed in as usual with vines, trees, buildings, and livestock enclosures," generally require an hour of flying time for each 40 acres.

For the benefit of those who would make their own dusting hopper, we give the following design and specifications by the U. S. Dept. of Agriculture. Preliminary considerations for the hopper suggested certain essential principles without structural changes in the plane: (1) a hopper with smooth, gaspermeable walls to permit vapors to settle to the bottom, from which they would be fed out by (2) an endless chain conveyor moving over the lower corners of the hopper; (3) an adjustable door at the front of the hopper bottom, through which the conveyor would deliver material to (4) a vertical pipe parallel to the fuselage and below the fuselage whence it would be driven by the rush of air beneath the plane and distributed in its wake, and (5) a wind-driven propeller to operate the mechanism through a reduction gear, with a brake controlled from the pilot's seat. Details are given in accompanying drawings.

Dimensional alterations would permit this construction to be used in a one-engine plane. The hopper described is of 28 cu. ft. capacity, for installation in a light plane powered with a 200 hp. engine with a cruising speed of 90 mph, and a payload-carrying hopper of 280 lb. at 10,000 ft.

Modeling Hopper Body

The hopper is mounted behind the firewall and fits the front of the cockpit at the CG of the plane. To insure safety and period knowing, this hopper should be furnished by mechanics thoroughly cognizant with the requirements of the plane.

The hopper is attached to the top fuselage by 1½-in. T-sections, while the bottom rests on the lower fuselage members, with wood strips clamping the hopper and conveyor unit in place. Hopper is also bolted to top wing.

Power tail, comprising a small propeller and reduction gear, is mounted on a bracket outside the fuselage and clamped to the longerons. These latter are protected by wood blocks and ½ in. wood strips. No parts of the hopper are attached to the fuselage without intervening wood or rubber.

As the weight of the load changes, the CG is still within the wings far ahead of the plane in approach.

Specifications for Hopper

Hopper is of sheet aluminum and uses all available space in the fuselage, the hopper bottom being approximately the width of inside fuselage. Hopper

has an adjustable door over outlet and of conveyor in requisite amount of material. Walls are supported by angle braces, and sheet aluminum door is 20 x 20 in., with the covering well braced round the opening.

Dustproof conveyor has links made of ½ x 1 in. 17 ST stainless steel, 4 in. apart. Malleable iron No. 32 chain is used, with R and L A-1 attachments. Conveyor is as closely as possible full width of the hopper bottom and is driven by four No. 32 5-tooth sprockets on ½ in. shaft. Sprockets should be turned out as light as weight as possible. Shocking is supported by dustproof, rubber, pillow



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So, too, must the plane measure up in performance and ruggedness to necessity's exacting demands, and we are proud to stress that American planes of all makes and types have delivered a magnificent performance to the honor and glory of the Air Corps.

It is, however, our gratifying privilege to point to records set by the Thunderbolt on all fighting fronts which not alone demonstrate its versatility, but "over and above the call of duty" stress its well merited reputation for "bringing them back alive."



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black ball bearings mounted to permit adjustments to be made on conveyor. Fork wearers are used. Service bearings and conveyor low sides. Conveyor box is 205 shaftless braced with 12 in. angles. Hopper door under conveyor chain is 204 aluminum with 14 T-section supports. Conveyor is bolted to hopper bottom, thereby clamping the assembly to the lower feed-er members, which are protected by wood, fabric, or rubber. Door, of full hopper width, should open at least 6 in. It is dropped when closed and is made of 307 25, 10 sheet aluminum.

Front is adjustable and is full width of conveyor box. Tube is made of 1357 aluminum alloy.

Power and is provided with 18 in. dia. propeller connected to 40:1 reducing gear on shaft of feed-er. A brake with 1 in. wide drum is mounted on propeller shaft and is connected by .187 cable to hopper door control. This is for the purpose of stopping the conveyor drive when hopper door is closed, preventing material from being packed into bottom section and damaging the mechanism.

Twelve south No. 41 sprockets are mounted on gear box, while conveyor shaft runs on Nos. 24, 30, or 43-tooth sprockets for varying speeds of conveyor. Mounting bracket is slanted to upper and lower lugs.

Controls for hopper door and propeller brake are in cockpit and are accessible to pilot.

All controls and openings where controls or cables enter fuselage or wings, should be protected by seals to prevent entry of dust.

Plan for Feederlines

(Continued from page 371)

When there is good snow, there is a weak line, but when the snow cover goes bad, the bottom drops out of this source of revenue in a few hours.

Area Certificates Proposed

The Port of New York Authority recently suggested to the CAB that it consider the issuance of an entirely new type of certificate for non-tradeline service—the area certificate. Such a certificate would grant a carrier the right to provide non-tradeline service within a described region. It would be written in such a way that the carrier would be left considerable discretion as to the precise towns to be served on particular schedules, thus providing a flexible operation. The carrier could then adapt the service to the need, with variance according to seasonal and other factors.

In confining the needs of secondary traffic service, it must be remem-

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based that the entire United States is divided, either by geographic or economic boundaries, into a series of areas which could be efficiently served by such airlines. Many communities may themselves accept adequate sufficient daily business to qualify as a profitable site for the multi-passenger machine activity of the future. However, their actual total transportation requirements probably will add up to a size business for a local operator who is able to shift his activities to any part of the area accordingly as the service is required.

Non-trunkline air service will, therefore, rather than compete with the trunklines. Through the development of an economic network of such centers, a great deterrent to full development of air transportation will be removed—that is, the present inability of the clientele to travel by air from a major city to communities off the trunklines.

Perdiene service builds out the promise of intensive cultivation of the short-haul air market. The average non-terminating rail trip is 146 mi., while 99 percent of auto and 90 percent of bus travel is within a radius of 250 mi. Only 2 percent of airline travel is now for less than 250 mi., and most of this is within the heavily-populated western around Chicago and New York.

Development of air transport as a medium of transportation will require the optimum development of short-haul services. Accompanying this article are maps of two areas—one industrial and heavily populated, the other mainly agricultural—with several cities of importance.

For example, in the State of Louisiana, the City of New Orleans is served by five airlines: Delta, the PL North and Atlanta, Eastern, to Houston and Atlanta, National, to Jacksonville; C & S, to Memphis and Chicago; and Pan American, to Guatemala and South America. These five connect New Orleans with only five communities in the state, but according to CAA data were 37 approved airports in the area at the end of this year.

These communities can be joined by fast, efficient, non-trunkline service through the issuance of area certificates under which the operators will not be tied down to restrictive and inflexible route-and-schedule patterns.

In the New York area the non-trunkline problem is somewhat different from that in Louisiana. Here, there is extraordinarily heavy truckline air travel between New York and Boston, Buffalo, Pittsburgh, and Washington. But between these trunkline routes it may smaller communities entirely without air service.

Regular trunk airline travel could not be profitably used in air communication for such short distances. For example New England and Eastern New York have 60 cities with populations ranging from 15,000 to 100,000, which do not have direct airline connection with New York City. Nevertheless, these cities, with a total population of about two million, have a definite community of interest with New York. They residents come to New York as the principal wholesale markets of the United States and the center for many business activities, such as accounting, advertising, credit reporting, and finance, thus guaranteeing a constant exchange of traffic.

In addition to commercial traffic, the extra area is important as a source for vacationers and work-orders from New York City and its environs. Air service can add a day to a week-end and two days to a vacation. It is natural, therefore, to expect that, on air transport, the whole area will increase in importance as a resort and serve an ever-expanding market.

The above instances could be adapted in varying degrees to almost all the states in the Union. They are surely examples of situations which may be found all over the country.

Need of our smaller communities for air service is immediate. And the development of a flexible certificate kind to the requirements of the non-trunkline operator will be a definite step toward meeting this need.

Wall Street Eyes Planes

(Continued from page 177)

panies, such as Ryan and Lomax, are still at the peak of their sales operations and are thus in position to steadily enhance their financial position. Lomax, for example, notes that double production in the first 4 mo. of 1946 over the first 10 mo. of 1945. Its first quarter sales were \$2,637,000 against \$1,283,000 a year ago. Ryan, announcing its 1946 orders a few weeks ago, placed this backlog at \$116,000,000.

A number of personal plane companies, including Aeromex and Piper, have paid their first common stockholder dividends within the last year. Usually, the placing of these stocks on a regular dividend basis only denotes a stabilized earning power but also makes the issues more attractive from the stockholder's viewpoint.

Procurement of loans for expansion and working capital is not the problem it was before the war in the small and middle sized company in any industry. We have had the Reconstruction Finance Corp. for more than a decade to furnish loans to railroads, banks, and

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large corporations, but this agency didn't figure actively in the small business field. Now, however, Congress and the administration seem to be looking over backward to make sure small business is assured of all necessary working capital in the reconstruction period and beyond.

The Opposing View

On the other side of the fence are those who see no reason for the investor to get interested in the personal plane stocks just because civilian production is being resumed. Nor are they impressed by eager possibilities. It is these customers, however, that the military plane makers have all the plans, facilities, and most of the organizations they will want power. It will, they say, be a case of skydiving rather than jumping. And the aircraft makers probably won't be interested in buying a stock, since their tremendous war production and success of their fighting planes has made their own names household words in some areas and given them all the prestige they need to introduce any product they wish to manufacture.

Some astute Wall Street observers will tell you that their interest in the aircraft industry has about 75% in military production, 15% in commercial transport output—and but 10% in the personal plane direction. In other words they feel that the aircraft industry need realize no special circumstances orders for its "bread and butter" production for an indefinite period ahead.

At the same time, with the possible exception of a few companies like Douglas and North American Aviation, these observers expect that nearly all the big companies now will make their bid in the personal plane field because of its acknowledged long-term future possibilities.

But, they reason, it's too early to get excited about these long-term possibilities. It is still a favored field with many new entrants. And it will be a long time, they venture to predict, before there will be a Ford in the personal plane field. Plans must be completed, in their view, so that the stronger general companies by design.

Peter W. V. Piper of Piper Aircraft Corp., largest power producer of private planes, made some observations to his stockholders last fall that are also quoted by those who are dubious regarding the immediate personal plane market. Declared Mr. Piper:

"Technical improvements will make the postwar plane more useful than the prewar models. However, it should be recognized that we do not have adequate airports and servicing facilities to accommodate a large number of air-

craft, and development of landing fields must go hand in hand with increased output of planes for civilian use."

Some Wall Street brokers take the position that it will be another year or two before the postwar picture in the personal plane field begins to take shape. And remembering the complexities that took place in the economic field after World War I, they counsel a "wait and see" policy. It was during the lull of the motor car industry's greatest era of expansion that many of the producers disappeared. It is still too early, they contend, to pick the winners in the personal plane field.

Meanwhile, there's no denying that the personal plane makers are getting off to a good start in their conversion to civilian production. They have general orders for thousands of planes with little effort, and they certainly have the drive at the start of their big potential customers who are still concentrating on military work.

Piper Aircraft, for example, expects to produce more than 5,000 planes in its first year of normal civilian output—about as many personal planes as the entire industry produced in any year before the war. Aeromac has received more than 65,000 inquiries concerning both aircraft operation and the purchase of light personal planes, and expects to begin delivering personal planes next month.

Recent market forecasts have predicted that around 20,000 personal planes may be produced in the light-plane industry's first full year of civilian production. Although this figure seems small in comparison with wartime military plane output, it is still more two and a half times greater than the previous peak.

Tudor and New Aeravan (Continued from page 177)

range of visibility. View here while taxiing is stated to be through 250 deg. and to within 18 ft. of the ground. The fuselage, affording a level looking floor, has a large single rear door to permit direct loading, or driving in of cargo. Straight-ended, maximum fuselage loadings is given as 6 ft. 6 in. with a storage capacity of 250 cu. ft.

Used as a passenger craft, light units would be handled, permitting seating up to twelve passengers. Another arrangement could accommodate eight students.

Wheels, cantilever wings, with 50-ft. open lower Miles external airfoil flaps and doped afores. The craft is 36 ft. in length and height is 13 ft. 4 in. Weight empty is stated to be 3,000 lb., and maximum payload is

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given as 1 ton. Fuel capacity is 50 gal. and with this, a range of 450 is performed. Performance figures include a 120 mph top speed and a cruising speed of 115 mph, and it is also stated that the Aerojet can take off at load weights 100 and 200 yd. according to load.

Spartan 4-S Placer

(Continued from page 175)

be able to fly from any moderate sized field, and will be capable of taking off over a 20-in. obstacle in 1,655 ft. using 32 percent flap. Further, it is expected that with 40-deg. flap and broken five, the Executive 12 would land in 1,269 ft., or with brakes locked, in 629 ft.

Price, in the present judgment, is estimated at under \$20,000, although with fewer accessories, it may go down to about \$14,000. Size, performance, and price indicate that the Executive 12 is intended for companies which are private air transporters, for business executives, or for the advanced sportsman pilot.

Planning Overhaul Shop

(Continued from page 161)

standard structure, would not be quite so efficient for a continuous-flow shop but in the other hand would adapt itself to intermittent process overhaul without the expenditure of large sums of money. Changes may be accomplished quite easily, or the building may be sold to another organization without undue loss. Unless the operator contemplates an exceedingly large shop with continuous-flow overhaul, and fresh called upon for the maintenance of production in the interim at one, it is not recommended that he invest a large portion of his capital in constructing a highly specialized building.

At this point it might be well to reemphasize the American business attitude that views overhaul "most for future expansion."

With an airline, for instance, where engine overhaul is clearly a factor in revenue cargo transport, it is quite possible to predict the rate at which overhaul facilities will need expansion to meet increased operating demand. For the repair station operator who regards engine overhaul as a revenue-producing unit in itself, the repair station is far too dependent on external variables for him to plan down his rate of expansion over a period of years.

The writer feels, on such organizations that should itself with enough

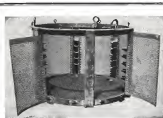
hangar space for a fleet of transport planes in spite of its relatively small market scope. Eventually, the corner of this magnificent structure was demolished in the owner's hobby-crazing gusto.

A nearby competitor, on the other hand, was less sanguine as to his prospects. He sat up bottom in a building so cramped that his hangar resembled the inside of an aircraft carrier. Prospective customers left the first hangar with an impression of an empty and dying business, whereas the actual shop always seemed really busy in spite of the crowding. The business sense solution to the "future expansion" problem would appear to rest in a carefully thought out shop plan that will permit the incorporation of new processes without disruption. The aircraft engine starts its journey in a dismountable, moves to cleaning and polishing, and continues through inspection, repair, adjustment, and final assembly, to return to the carrier as an airplane after test. Whether or not preservation and packing constitutes a true overhaul step is an unending question, but the overhaul company will profit by giving engine preservation to much attention as he does any other shop function.

When the decision has been made to operate a shop within certain definite capacity limitations, it is time to arrange a tentative floor plan. Shop space requirements will, of course, be a function that fluctuates irregularly and automatic movements of engine parts as they go through the shop. Some conditions usually arise because operators are not cognizant of the basic overhaul sequence, or because the stress of daily business overrides their good intentions.

Shop supervisors who recommended a smooth flow of parts through the shop, are frequently thwarted in their attempts to achieve this ideal. On paper, a given layout may indicate a good pathway between cleaning and repair in the best spot for inspection, but the building construction might make it desirable to place the inspection benches elsewhere to take full advantage of natural lighting. Floor load limitations, drainage, or ventilation, often prove to be a factor other than the one theoretically desirable.

An excellent example is found in the cleaning department's location. While it is desirable to place cleaning shop inspection, there are difficulties in keeping dirt, vapor, and corrosive materials away from the clean parts and delicate instruments. Two solutions usually are offered. The first involves steps to send the cleaning department from the roof of the shop to ventilate to the outside air in such a manner



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fast working will lead its way back through open windows and doors. In the second system washbasin and clean-out tanks are located separately at some point well away from the shop proper, but if parts are checked from one building to another, protection must be provided against rain and dust.

Each time they appear trivial to the inexperienced operator, but a great deal of work in a master tool bearing shop absorbs a month's profit.

From the standpoint of accessibility a test stand just outside the tool assembly shop does it best, but test stand cover is a handicap to employees contributing heavily to fatigue, irritation, carelessness, and also misassembly.

Continuing the discussion of shop layout problems, let us consider the sub-assembly. Small engines do not break down into the extensive areas of sub-assemblies common to larger engines. Subassembly build-up of a single rear section or nose section from a 1,200 plus hp engine represents far more precision work than does the complete build-up of a 50 or 60 hp lightplane unit. Moreover, the major sections will disassemble into secondary sub-assemblies, and each of these divisions requires a specific area for its construction. Obviously, a shop fitted to the needs of the lightplane engine will be hard pressed to overhaul larger aircraft engine power plants.

Paradoxically, it may be wiser to arrange the shop machinery in a manner that is quite inefficient with respect to the engine overhaul sequence. For example, an operator covers an expensive piece of equipment whose capacity exceeds the requirements of the engine overhaul shop by placing this machine where it is available to another department, he may be able to derive maximum utility from his investment. Many airlines group their machine shop equipment without considering the inconvenience involved in moving engine parts into the machine shop where that particular overhaul is needed. From the standpoint of engine overhaul, this is inefficient, but when fitted into the overall pattern, it is good business.

Work-in-process has been aptly tagged as "the graveyard of shops". Now parts and high payroll charges represent money invested with no return until the job is paid for. If there is no chance of including all the interest on tick-up money in the customer's bill, a further stimulus for fastening jobs rapidly. There is also the problem of storing finished parts while awaiting their other work. Storing requires labor for cataloging, requires storage areas and there is a waste of space, and calls for

more man-hours to move the stored parts.

Two factors affect the completion of work: First, the general shop layout and equipment; second, efficiency of scheduling orders. The experienced flagboard scheduling results in overloading a few machines while others are unused, also the inspection or cleaning sections, while assembly or repair is measured. Such arrangements cause unnecessary expense and machine work, and are likely to result in dissipated customer. For these reasons jobs in an overhaul shop should be as carefully scheduled as pieces on an assembly line. The shop superintendent should know each job, its location, and stage of completion at all times. Nothing but chance can otherwise result.

Let us examine the layout of several typical overhaul shops. The shops in our accompanying figures are tied in with aircraft repair stations. The first diagram (Fig. 1) shows a typical small airline shop. This airline maintains 15 1,200 hp engines with 30 men. The shop is 42x52 ft overall. Engines enter at the upper right where removal from the airplane. Usually removed and placed on stands while in the main hangar, engines are eventually trucked in. A two-ton overhead at the shop entrance handles such cases, as well as equipment and parts entering the shop.

Once inside, the engine is disassembled and the parts cleaned. Parts are carried by the parts to the centrally located inspection benches, or in the case of accessories, to a small separate shop with special equipment. The disassembly and cleaning section contains 800 sq. ft., the accessory shop 300 sq. ft., and the inspection department 500 sq. ft. When inspected, the parts move into the assembly area and are distributed to the respective repair sections. A special area is devoted to cylinder overhaul. The machine shop handles repairs and repairs of a general nature. Subassemblies are built up on the benches along the machine shop and stockroom wall. Final assembly is accomplished in the central area under the two overhead hoists.

Completed engines move into the hangar for reworking in a portable test cell. Final assembly requires 1,800 sq. ft., and the machine shop needs about 600 sq. ft. A stockroom at the extreme left offers a convenient supply of parts, small parts, and accessories, while the centrally located office assures that no section is too remote from supervision. This layout is well adapted to the custom shop type overhaul. The location of the engine department might be criticized from the standpoint of poor natural lighting, but a carefully planned system of artificial il-



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To be more specific, let us assume one mechanic is working on an engine assembly that requires the accomplishment of another mechanic's task before it can be completed. Rather than waste time waiting for that second operation to finish, the first mechanic will step into the engine department for a few hours, or if his services are not needed there, he might go ahead with the lubrication of a special tool to add to the shop equipment. Such work, which

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5 CLEANING METHODS IN ONE UNIT

can use for themselves what needs to be done, are the backbone of a successful unit shop.

Storage and warehousing facilities are necessities in aviation activity at an overhaul shop. If many engines must be stored, some thought should be given to a structure that will keep them clean and dry. Moreover, it is extremely important to make arrangements to engine houses may be opened for periodic inspection.

To maintain the best rule is fundamental to setting up an engine overhaul shop. Decide what the business scope will be—then match the structure, equipment, and personnel to the location.

CAB and Airline Securities

(Continued from page 179)

railroad companies, generally, to secure the funds needed to provide the public with adequate transportation facilities.

The contrast of the over-all capital structure of the airlines with that of the railroads, where complex capital structures and numerous debt financing through bonds are commonly encountered, is striking. It is true, of course, that the relatively small fixed plant and properties owned by an airline do not encourage much borrowing as a long-term second loan, but this is perhaps an advantage in the long run. Equity as stock financing, which has a security less based on the physical, is particularly desirable in times of poor earnings when a collapse of dividends is accordingly all that occurs rather than, before, to meet bond interest charges with consequent delinquencies. This is something that the railroad companies have, in many instances, learned too late.

As a general rule, transportation organizations of any kind, when over-capitalized, cannot earn a fair return on the face value of their securities. In such cases, however, it is a natural tendency on the part of these companies to pay large dividends and to use for this purpose money which is in part made available by the failure to properly maintain their properties. This has often been the situation among the railroads, but because of the small amount of airline capital invested in anything but operating equipment it is unlikely to become the case with these companies. It appears that the airlines, at least up to the present, are also immune to the possibilities of foreclosure due to defaults on bonded indebtedness.

The current capital needs of the airlines arise out of the necessity of keeping abreast of aeronautical ad-

vance by the purchase of new transport and operating equipment. As time has passed, raising of capital by these companies has become less difficult, and the nature of their financial structures has become a favorable factor in the connection. For example, lower shares of additional stock can be sold at higher prices to obtain required money, leaving capitalizations still relatively small and simple. Raising of additional capital is aided by the fact that new funds go directly into flying equipment which shows immediately in product revenue.

The airlines are not faced with the problem of making large outlays for land, roadbeds, tracks, bridges, and the like, as were the railroads. Even when new routes are obtained by ex-airline, practically the only capital cost may be for additional flying equipment and some airport and traffic control station expense. It is likely that for some time to come the financial needs of the airlines, as well as those of the manufacturers who sell their equipment, can be met in roughly the size of the capital outlay, the condensed interest contract, and the equipment trust certificate.

To be sure, as the CAB points out, the ICC was given the power to regulate railroad securities by the Transportation Act of 1920, but it must be remembered that this grant of power was not an embroilment shewing by itself but was, instead, an integral part of a comprehensive system of regulation of interstate commerce and interstate carriers. At that time, Congress rightly considered that the most essential and vital object of regulation was to bring about an adequate transportation service, and that the credit of the railroads was the foundation upon which service of these carriers rested.

That such credit might be established, after the period of Federal operation of the railroads, and further strengthened and retained, Congress adopted several measures among which was the regulation of the securities of these regulated carriers. Securities, provided by Congress not solely for the protection of investors, nor for the express purpose of avoiding conflicting State regulations, but as a necessary part of the construction program whereby the Transportation Act of 1920 sought to build up the nation's railway system so they would be prepared to carry an increasing amount of traffic.

No comparable situation as to the airlines exists today. Instead of being saddled with such an onerous financial background, the airlines are in an excellent financial position with as much history as had the railroads.

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In fact the existence of the Securities and Exchange Commission, something unknown when the railroads were passing through their financial vicissitudes, is probable all we need both now and in the future to protect investors and the railroads themselves.

And since the airlines may meet their financial needs by the comparatively simple methods mentioned above, the question arises as to whether there is any real need for the CAB to be granted an additional regulatory power over the airlines, such as the Board now requests. Certain objections may be raised to this type of control, as follows:

1. CAB control would place the airlines in such a position that they would probably be unable to take advantage of favorable situations in the money market. Changes in this market are often sudden. An airline could not act as quickly as it can now to take advantage of some favorable opportunity, if the securities to be sold had to wait, in advance of sale, approval of some public body other than the SEC. Such approval could only be given after investigation, which would, if previous experience in CAB matters is any criterion, cause actual delay.

All government regulations tend to bureaucracy, delay, undue expense, and waste of time by all parties concerned. No matter how simple the case, a day must be set for a consideration of each case by itself, and some time must be allowed for each. Any government bureau is handicapped in conducting its business, because once a case is taken first it has to give everyone interested an opportunity to be heard, due to fear of criticism by Congress and, also, lest through a short cut it might be guilty of an error of judgment for which criticism might result.

2. CAB control could be objectionable because it might tend to mislead investors and thereby injure instead of benefit them. If the CAB should, for example, set a maximum price for an issue of stock or possibly bonds (if the airlines should ever have to resort to this type of borrowing), it would thereby appear to place its approval on their value. Many investors would buy securities, because of faith in the Board's judgment. It might well soon develop, however, that the Board could make mistakes. There would be many cases where securities could not yield the expected returns or lose even the established price in the market.

Judging, however, from experience of the SEC in regulation of railroad securities this may not be a very strong

argument. In the case of railroad stock and bond issues, investors have not relied very heavily upon the judgment of the Commission. In fact, a survey conducted by the writer revealed that very few investors knew that the SEC had anything to do with the railway securities they were buying. The same lack of understanding was also true regarding the average "financial hunter" (as distinguished from the "investment hunter"). Correspondents with a large number of members of the American Railroad Association, revealed the fact that many, while they knew of the work of the Commission in rate matters, were entirely unaware of its work in connection with railroad securities.

3. CAB control would tend to restrict airline expansion and foster further paternalism in government by transferring too much detailed authority over these carriers from their responsible managers to public officials. There might easily be an issue in the unfortunate tendency, already apparent, for the Board to encroach upon functions of actual airline management.

In defense of the Board it should be recognized that it is often difficult to say just where regulation leaves off and management begins. So many of the activities of the airlines are today directly under the control of CAB that the area left open for free action of the boards of directors of such carriers is considerably limited. Of this area left clear for free action the part devoted to questions of finance is perhaps the largest, and surely not the least important. It would seem to be the best policy for the Board to refrain from entering that field, other than upon the clearest evidence of public necessity for so doing. Under the management of an airline possesses a course of action which is clearly opposed to public interest, the Commission should refrain from interfering with the management's judgment.

Congress has relied upon private management and enterprise for providing an efficient air transportation service. This would seem to imply that the Board, in carrying out its regulatory tasks, should leave all possible scope to the carrier's managers, subject to considerations clearly affecting public welfare.

Review of Patents

(Continued from page 188)

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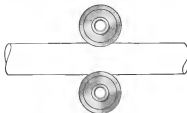


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AVIATION, August, 1945



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AVIATION, August, 1948

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If you're doing small welding jobs, this control can undoubtedly help you speed up production by providing precise welding control, and thereby reducing rejects. Our local office will be glad to send you further information on the CR150-AJ-00A2 timer, or talk over the possibility of installing these controls on your assembly line. However, if you prefer, write directly to General Electric Co., Schenectady 5, N. Y.



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GENERAL ELECTRIC

AVIATION, August, 1948

LOW-RESISTANCE CONNECTIONS FACILITATE USE OF ALUMINUM AIRCRAFT CABLE!

Tests on New Burndy Method show high electrical and mechanical efficiency

One of the drawbacks which has seriously retarded the use of small-sized aluminum cable for electrical conductors has been the difficulty of making reliable, permanent, low-resistance connections. This is due principally to the tenacious, transparent film of aluminum oxide ordinarily present on the metal. The oxide not only causes extremely high contact resistance between the outer cable strands and the connector contact surface, but it also causes high transverse resistance from strand to strand within the cable itself.

Public utilities and other users of large-size aluminum conductors have solved this problem by cutting contact surfaces with a protective compound and then scratch brushing to break up the oxide film. This method is impractical, however, with small cables which have a large number of small strands, and where the connectors used have small barrels.

Table showing effect of treatment on connection resistance

Treatment of Contact Surface	Method of Stripping Compound Used	Resistance in Milliohms Connectors Length Cable	Relative Conductivity, %
None	None	110.41	41.74
Not finished	None	58.93	51.74
Stripped	Stripped	79.76	44.74
Stripped	Stripped	10.57	91.74

A Practical, Efficient Solution

Intensive research on this problem by Burndy Engineers, has resulted in aluminum connectors which provide connections not only permanent and high in electrical efficiency, but also practical from the standpoint of convenience and over-all costs. In fact, installation procedure remains identical with the present rapid method of installing small wire connectors with a Burndy Hystad.

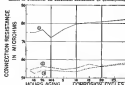
In manufacture, the surfaces of these new Burndy aluminum connectors are etched chemically, and while the oxide-free surfaces are still wet, they are zinc fluxed, and later plated with zinc to provide a mechanically strong coating. Then, the reformation of the oxide film is prohibited.

The barrel of each zinc-plated connector is then filled with a special compound of zinc dust suspended

in petroleum jelly. Thus, when the cable is inserted into the zinc-compound-filled barrel, and the connector is inserted to the cable with a Burndy Hystad, the compound is forced down between the strands of the cable. This breaks through and dispenses the oxide film on the individual strands, and prevents further formation of oxides or other products of corrosion.

As will be noted from the table, the electrical conductivity of the finished connection is practically double that of an ordinary zinc-treated aluminum connection.

Effect of corrosion on electrical resistance of connections



Curve 1: Contact surfaces not fluxed, not treated. 2: Contact surfaces fluxed and coated with compound. 3: Contact surfaces fluxed and coated with compound.

The curve shows clearly the ability of these new Burndy connectors to maintain a low resistance after exposure to corrosive agents.

It should be remembered, however, that the most satisfactory method of connecting aluminum cables is by the longitudinal indent method. For only this type of indent forces the individual strands to shift and rearrange themselves, thus ensuring a wiping action on each other which helps to remove the oxide film.



Burndy Hystad Indent-type Connectors



Laboratory Report Available

A complete laboratory report on this new Burndy method of connecting aluminum aircraft cables has been prepared and copies can be secured by writing to Burndy Engineering Company, Inc., 167A Broadway Blvd., New York 24, N. Y. ADVT.



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Micro Switch supplies these switches with attention to extend their usefulness and with die cast housings designed specifically for aircraft and aircraft accessories. They insure the ruggedness and long life that aircraft usage demands.

The Switch . . .

The Type R-31 Switch, of which millions are in use in the aircraft industry, employs the same three-bladed beryllium copper spring construction which has proven so successful in every branch of industry. Contact separation of the R-31 is .005" to interrupt highly inductive loads in extreme shunters satisfactorily. Knurled contact surfaces insure positive operation in extremely small loads.



Close-up view of the Type R-31 switch but shows detail about the three-bladed beryllium copper spring which is the patented heart of Micro Switch products.

The Actuator . . .

Many types of Auxiliary Actuators are provided to protect the plastic enclosed switch against the abuse of service and to make possible the operation of these switches by unusual actuating motions. These actuators make it possible for these snap-action switches to serve particular purposes, such as throttle warning indicators. In some designs they afford easy means of installation and adjustment and also facilitate ready field replacement.



Type "A" actuator which provides for field adjustment of the operating level for free position, for switch operating point, and for pretravel.

The Housing . . .

Die cast enclosed switches, with special actuators, are available in housings of die cast aluminum. They are standard equipment in industry and commercial aircraft because of their combined ruggedness, light weight, compactness and high electrical capacity. Their long operating life assures reliability and a minimum of maintenance. These enclosures are provided with a choice of cushion fittings and are available in side or bottom mounting types.



Example of the Type "T" switch of aluminum housing. No housing can be sealed against dirt, oil, or salt. All other fittings are optional.

See Your Nearest Distributor



LET'S ALL BACK THE AVIATOR—BUY EXTRA WAR BONDS

SEND FOR THIS CATALOG

Send for Micro Switch Handbook-Ordering Die 11 for complete details on the entire line of Micro Switch snap-action switches, actuators and housings for aircraft use. We will supply to meet you as your engineers require.



BRIGGS PREPARES FOR PEACETIME MANUFACTURING



\$626,000,000 IN WAR BUSINESS

51.7% FOR WAGES \$323,846,660	3.16% FOR DIVIDENDS \$13,320,000
34.32% TO SUPPLIERS \$214,000,000	1.36% FOR DEPRECIATION \$6,900,000
6.86% FOR TAXES \$55,856,000	.86% FOR RECONVERSION \$4,500,000
.71% LEFT IN BUSINESS \$4,450,000	

Briggs has just completed \$626,000,000 worth of war business—1942 through May 31, 1945—covering principally of heavy aircraft accessories, heavy bomber barrels and heavy and medium tank hulls. Its employment rose from 33,000 to 56,565 in the same period, and it added almost a million square feet of floor space to its manufacturing facilities. Still on the books and in production are many more war orders.

Changes in War Requirements Free Space for Peacetime Work

Now, however, due to changes in war requirements, facilities devoted to war work have been decreased about 20%, thus permitting the Company to continue to be able to meet its war contracts, and at the same time to begin to prepare for peacetime body manufacturing.

New Foundry Established in Cleveland

The reduction in war work also permits Briggs to make peacetime plants in other fields. For some time the Company has been experimenting with plastic molding. Beginning with April of last year, it put into operation on war work a huge new facility in Cleveland, Ohio, using plastic molds exclusively and founded under what is known as the "Capex Casting Process." This will seem to be available for making automatic and fine castings for peacetime manufacturing.

Plans Laid for Postwar Plumbing to War Market

Briggs is also planning to enter the plumbing war market on a large scale. On September 30, 1944 the John Douglas Com-

pary of Cincinnati, Ohio, was purchased—one of the country's oldest independent manufacturers of plumbing ware and plumbing fixtures. In acquiring this Company, Briggs has added enough plumbing ware facilities to what it already has so that it will be able, in the postwar market, to offer a complete line of plumbing ware for practically all purposes.

1944 Profits After Taxes Were \$5,307,161.19

Briggs' profits after taxes in 1944 after provision for reorganization of war contracts, costs of plant reconstruction, and other costs arising from the war, were \$5,307,161.19, as compared with \$1,539,500.74 in 1943.

The consolidated financial position of the Company and its domestic subsidiaries on December 31, 1944 showed current assets of \$28,657,899.64 and current liabilities of \$54,300,994.69, as compared with current assets of \$9,657,442.49 and current liabilities of \$17,970,669.79 in 1943.

The Company paid a \$2.00 dividend per share of stock in 1944, the same as in 1942 and 1943.

To Spend \$10,000,000 On Reconstruction

Briggs' future plans call for the expenditure of approximately \$10,000,000 for reconstruction, re-equipping and new machinery. However, the Company believes that its principal job must continue to be production for war until final victory has been achieved in the Pacific. Until that time, the needs of the Armed Forces will always come first.

BRIGGS MANUFACTURING COMPANY—DETROIT 14, MICHIGAN

IN WARTIME:

BODIES FOR BOMBERS, FIGHTERS,
TANKS AND AMBULANCES, AND
BOMBER TURRETS.

IN PEACETIME:

BODIES FOR PASSENGER CARS AND
TRUCKS PLUMBING WARE AND NON-
PRESSURE CASTINGS.



NEVER before sacrificed with the "best" is the motivating force of science. The same spirit prompts Globe to maintain complete chemical and physical laboratories for steel tube research and for production control. The scientific approach explains why uniformity and quality are so accurately controlled at Globe. Whenever the tube requirement, Globe usually has the answer, based on these essential facilities — practical experience, manufacturing skill and specialized knowledge. You can be sure of uniformity and quality when you specify Globe tubes — pressure, mechanical or stainless.

GLOBE STEEL TUBES CO., Milwaukee 4, Wis.



- Pressure Tubes
- Condenser & Heat Exchanger Tubes
- Expansion Devices
- Heat Tubes
- Mechanical Tubing
- Structural Welded Tubes
- Hot Steel Tubes
- Gasoline High Purity Steel Structural Tubes



**Her job helps to make
flying the Atlantic on the Pan-American "Clippers"
as easy as commuting on the 5:15**

Fuel injection lines are vital parts of an airplane engine. They are the "arteries" of the throbbing heart of the plane. These tubes twist and turn in and around the complex engine assembly, yet they must fit with absolute precision—or these great Clippers of Pan-American Airways could not fly.

This is but one of the many complicated precision jobs of tube bending which is all in the day's work at American Tube Bending Company, Inc.

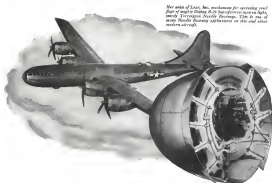
It is the pioneering engineering ability, the work of highly skilled hands, the designs of experienced special machinists and processmen and the irreplaceable experience of 50 years of cooperative teamwork, of experimenting and perfecting that has brought the art of tube bending to its present high status at the American Tube Bending Company, Inc.

We bend tubes—from the tiniest oil line to a 5 inch airplane exhaust ring—into all kinds of complicated shapes

and turns. Square, round, flat tubes are reduced, expanded, flared, flanged, beaded, swaged and welded—for airplane manufacturers, radar, automobiles, refrigeration, dairy equipment, etc. If you have a job or a problem of tube bending, we suggest that you put it up to us.

Write for booklet "Precision in Tube Bending" to American Tube Bending Company, Inc., 9C Lawrence Street, New Haven 11, Connecticut.

**AMERICAN
TUBE BENDING
COMPANY, INC.**
PRECISION to aircraft standards



Her unit of Torrington, Inc., mechanism for operating cowl flaps of engine driving B-29 Superfortress seen on right, easily Torrington Needle Bearings. This is one of many Needle Bearing applications in the and other modern aircraft.

**Needle Bearings Help Operate Cowl Flaps
of B-29 Superfortress**

Modern aircraft design requires that each moving part do its job with complete reliability, yet at the same time possible cost in energy, space and weight. Hence, on the B-29 Superfortress, it's only natural that part of the mechanism operating the cowl flaps of the four mighty engines runs on light, compact, ready Torrington Needle Bearings.

Skillfully engineered for low coefficient of friction, Torrington Needle Bearings are economical in cost, simple to install, retain lubrication efficiently, and handle heavy loads easily. Where space means life for

such bearings packed into the fewest possible ounces of metal, design engineers usually specify Torrington Needle Bearings.

If you design or build aircraft, automotive or related equipment, you owe it to yourself to know the full story of Torrington Needle Bearings in terms of your product. Our Catalog 32 gives full data on types, sizes and applications. May we send you your copy today?

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ELECTRONIC ILLUMINATION CONTROL

This Electronic Device for control tower beacons automatically furnishes unfading controlled illumination within any required range of daylight measured in Foot Candle Power.

The unit is weather proof and the tubes have a life of better than 5,000 hours.

The initial cost is low and the upkeep negligible.

AND LOW VOLTAGE AIRCRAFT TRANSCEIVER

MODEL BRT-5



An unusually compact self-contained radio voice receiving-transmitting communication unit. Works directly from 24-28 Volts D. C. without dynamotor or vibrator power pack. Transmitter & Receiver fixed frequency, crystal controlled. Operates anywhere in the four to seven megacycle band. Current drain is less than two amperes, including transmitter operation . . . Aluminum Cabinet, Chassis and mounting. Weight, only 10 pounds. Height 6 1/4"; Depth 6 1/4"; Length 12 3/4".

We also Supply Electronic Door Operators for offices, baggage rooms, shops and hangars. Write for prices and delivery schedules.

Advise us of your particular needs in either of these types of equipment and we will furnish you with information on the units we make which will best meet your requirements.

UNITED CINEPHONE CORPORATION

18 NEW LITCHFIELD STREET

TORRINGTON, CONNECTICUT

THINK IN TERMS OF MAGNESIUM

consider this extruded shape, for example



• The hollow extruded magnesium shape was designed by American Magnesium to give the textile mills a better cloth roll. It has a degree of permanence never before attained light in weight, these rolls make handling easier, simplifying a labor problem.

Strong and stiff, they're able to stand up under heavy loadings. There's no distortion, no cracking, no splintering.

Doesn't this shape suggest some interesting possibilities to you?

The extrusion process helps you employ metal to best advantage. Magnesium lets you save weight most efficiently. We'll gladly work with you in adapting both advantages to your products. Aluminum Company of America, Sales Agent for American Magnesium products, 1213 Gull Building, Pittsburgh 15, Pennsylvania.

MAGNESIUM **MAZLO** PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA



Don't take our word for the fact that the rugged construction of Crescent Electric Trucks results in almost unbelievably low replacement parts costs. Here is an actual case that proves Crescent's economy with facts and figures.

The ----- Sugar Refinery operates 46 Crescent Electric Industrial Trucks—

16 of them are over 12 years old
8 of them are over 22 years old
12 of them are over 21 years old
10 of them are over 18 years old

The average age of these trucks is 18 7/8 years.
The average cost of repair parts for the last seven years
—after these trucks had already been in service for an
average of over 12 years—is only \$278.00 per truck.

Operation and maintenance cost of Crescent Electric Trucks also is extremely low. Follow the lead of leading industries—Crescentize your plant and cut your materials handling costs.

*Some on request

FREE CATALOG pictures and descriptions of Crescent models now being manufactured. It will help you to choose the right Crescent for your materials handling needs for a long time!

CRESCENT TRUCK COMPANY
230 Silver St., Lebanon, Pa.

Representatives throughout the United States; send your checked telephone directory.

Crescent **ELECTRIC** TRUCKS AND TRACTORS
Industrial Truck and Tractor Specialists Since 1917

Announcing TRIGGER-FINGER Control for 10, 15, and 20-lb. fire-fighters



AT THE PULL OF A SINGLE FINGER...
The new valve on these larger sizes of Kiddle portable extinguishers opens with the same ease that this long used is popular feature of the 2- and 4-pound sizes.



THE FULL FIRE-FIGHTING FORCE...
All the action of the discharge gas and action of foam—in both-way operation with the new valve. When trigger is released, shut off is complete and instantaneous.

And here are the **PLUS** features of this Revolutionary Development

1. Lock-open control is simple and sure. A slight forward movement of the trigger finger latches trigger open—no danger of losing.
2. No replacement parts are needed for recharging.
3. Hydrostatic testing can be carried out without discharging. No devalving for repairs either.
4. Recoil outlet is of improved design.
5. Balanced handle design and low center of gravity make it easier to carry these bigger sizes of extinguishers.
6. Intermittent or continuous control is provided for.
7. The locking pin cannot jam. It seats in blind holes—there are no projecting ends to get bent over.
8. Streamlined design improves appearance.
9. Seal wire is fully visible for quick inspection.
10. Valve design is simple, fool-proof. The natural way's the right way to operate it—even a novice can't make a mistake!
- 10, 15- and 20-pound extinguishers equipped with this new valve will be ready for delivery October 1. Place your order now.



The word "Kiddle" and the Kiddle seal are trademarks of Walter Kiddle & Company, Inc.

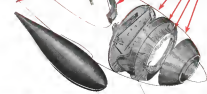
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GENERAL AIRCRAFT EQUIPMENT

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SOUTH NORWALK, CONN.



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CHUTE BOXES
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CONTAINERS
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Today the specialized skill and "know-how" of General Aircraft Equipment, Inc. is devoted to producing major airplane parts for the Armed Forces.

Army and Navy planes in all corners of the world carry General Aircraft Equipment's major assemblies. Stainless steel products as well as aluminum alloy parts have become General Aircraft Equipment specialties. We are proud of their performance, just as we are proud of our Tool Division's development of "BOROCOLLOT", the revolutionary cut Boron-Cobalt Invar alloy from which we

manufacture cutting tools that make it possible for war industries to machine more material, faster. The continuous, outstanding record of production achieved by our five plants would not have been possible had it not been for the cooperation and services rendered by the men and women of the Company.

When victory is finally won, the same engineering and manufacturing ability that has contributed so much to the war effort will be ready to solve your postwar aeronautical and industrial problems.

In Canada: GENERAL AIRCRAFT EQUIPMENT OF CANADA, LTD., MONTREAL, QUEBEC

**SPECIALLY
BUILT**

Electric Motors
From 1/32 hp to 100 hp



ROTARY ACTUATOR

Self-contained unit—1/2 hp motor with magnetic clutch and brake—Compressed phenolic and worm and gear gearing gives a reduction of approx. 15:1 to 1. Maximum drive shaft torque is 6000-inch pounds. Can be wound for a 20 or 50 volt system—Output 1/10 rpm.



LINEAR ACTUATOR

Self-contained unit, 1/2 hp, 1500 rpm motor—With magnetic clutch and brake—A double cam gear reduction gives slow motion gear reduction providing 25" travel on the jack in less than 2 seconds, with 1800 pounds max load—Control gear reduction drive opens and closes linear travel switches.



MOTOR DRIVE

Intermediate duty type, 2 hp, 1500 rpm motor, with magnetic clutch and brake—Thermally protected unit protected against overload in duty, stall or lock up—Designed for low impact torque.



MOTOR DRIVE

Thermally protected 1/2 hp motor—With magnetic clutch and brake—Complete unit weighs 48 pounds—Stack output is 1/2 inch per minute at 1200 rpm—Brings 2 to 4 inch reduction in work volume of various loads—Shock reduction and worm drive ratios cause for best motion control.



ELECTRIC PUMP DRIVE

A 1/2 hp intermediate duty, 2 hp, 1500 rpm motor with magnetic clutch and brake—Designed for precise timing operation—Standard AN motor—Standard 12 volt system—Weight, 12 lbs.



SPLASH PROOF INVERTER

Designed to operate 12 volt d.c. current into 180 volt 60-cycle a.c. current—Totally enclosed, fan-cooled model with 100 volt ampere capacity—Continuous duty, 500 volt ampere peak capacity—Standard duty—Can be adapted for use with a power supply source of 110 volt d.c.



RIGHT ANGLE BLOWER DRIVE

Compressor duty type, 1/2 hp, fan-cooled, 1700 rpm motor with magnetic clutch and gear drive—Gear ratio of 1 to 75—Efficiency—For use in a 12 volt system—Efficient motor lubrication.



SEALED VAPOR PROOF MOTOR

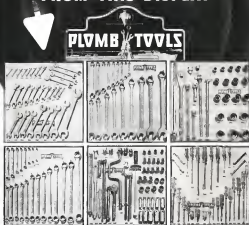
Double enclosed 24 hp d.c. commutator type motor—Integral gear reduction of 18 to 1—Approximate output 2000 in-lb—Rated capacity 1500 ft for 15 minutes—12 or 100 volt d.c.—Innovative fan cooling system.

EEMCO

ELECTRICAL ENGINEERING AND MFG. CORP.

4406 West Jefferson Boulevard, Los Angeles 16, California

BUY WITH *Confidence*
FROM THIS DISPLAY



... AT BETTER DISTRIBUTORS EVERYWHERE*

Advanced design, dependability, high quality ... these are some of the advantages you get when you choose the tools you use from the complete Plomb line.

You'll find it pays to deal with Plomb distributors, too. For the Plomb display identifies a

house that is building its business on quality and dependability ... in the tools it sells and the type of service it gives. Make the Plomb distributor your tool headquarters ... Plomb Tool Company, 2221 Santa Fe Ave., Los Angeles 54, Calif.



You'll get real satisfaction from Plomb tools in two important ways. First ... you'll be proud of their *dependability* and professional appearance. Second ... you'll profit in the faster, better, longer-lasting service they give.

*Illustrated are 6 of the 14 Standard Type Plomb Display Boards



An Outstanding
New Development in
PAINT STRIPPERS

Plan these jobs around with
Paint-Gon ready to be laid off

Turco Chemists Present Paint-Gon with 3 Outstanding Advantages

1. BENEFITS OF THE MATERIAL UNDER THE FINISH—

new Turco Paint-Gon is safe and non-corrosive to all widely used metals and woods; will not attack aluminum, magnesium, steel, cadmium, zinc, zinc, or galvanized; nor will it warp or raise the grain of wood.

2. ADVANTAGES OF THE TYPE OF FINISH—new Turco Paint-Gon is effective on all kinds of coatings—paint, enamel, baked enamel, varnish, lacquer, automotive synthetic enamel, baked varnish, or dry synthetic enamel, and even such stubborn finishes as baked zinc alloy and through the action of the stripper alone without scraping, scrubbing or blasting.

3. BENEFITS OF THE CONDITION OF THE FINISH—new Turco Paint-Gon readily removes unwanted finishes, regardless of their condition,

regardless of the number of coats, whether the finish is baked on by blasting desert sand, or enameled, or painted.

Paint-Gon is swift in its action, removing coatings in five to twenty minutes so that it may be flushed away, leaving no gummy adhesive residues or films.

Paint-Gon may be applied by brushing, scrubbing or spraying, spreads easily and uniformly, clings well to vertical surfaces. It is non-inflammable (and does not require use of inflammable, volatile solvents), is water removable, exceptionally long-lasting. Product itself is stable, non-separating, has no tendency to coagulate, causes no trouble in shipping, storing, or handling.

Phone your nearest Turco field representative, or write Turco today. Dept. GGG

A product of Sulfon Chemistry



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TURCO PRODUCTS Inc. Main Office & Factory: 6111 S. Central Ave., Los Angeles. Offices & Factories: (2) W. 40th St., Chicago 5; 1806 Henderson St., Monroe, La. Texas Office and Warehouse: 412 Commercial St., New York City 13; Atlanta, South, San Francisco, Kansas City, Denver, and all principal cities.

AVIATION, August, 1955

AVIATION, August, 1955

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IS IT LATER THAN YOU



Oiljak, like other American manufacturers, continues to devote all its facilities to the production of war material, to speed the approaching day of victory.

Yet, at the same time, we consider it no less our duty to plan for the future, to do our part in easing the change-over to a healthy industrial economy during the competitive peacetime years that lie ahead of American industry.

Oiljak offers you complete manufacturing facilities with up-to-date machines operated by men whose production record on war contracts compares favorably with normal peacetime costs; a record achieved by a minimum of rejections, a steady streamlined flow of work and materials through the plant, and a special assembly-line technique for which Oiljak is famous.



So before you set up the manufacturing procedure for your peacetime products, it may well be worth your while to get acquainted with all the facilities which Oiljak can offer you

MACHINING • STAMPING • WELDING • PLATING • FINISHING • ASSEMBLING

METAL MANUFACTURERS

THE OILJAK MANUFACTURING Co., INC.

MONTCLAIR, NEW JERSEY

THE JOB COMPLETE FROM BLUEPRINT TO FINISHED PRODUCT



From Bunting you can now obtain finer Bronze Bearings than any ever before produced in volume. Today these advanced Bunting Bronze Bearings bring a new and greater measure of performance, endurance and precision to all machinery. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Warehouses in Principal Cities.

Bunting

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS



CLECO B1

The scaling tool of many uses:

SCALING
PEINING
BEADING
REMOVING RUST
REMOVING WELD
SPLASH
REMOVING SAND
FROM CASTINGS

toward the work, removing chips and scale and insuring good visibility at all times.

The novel chisel retainer of the Cleco B1 holds the chisel securely when working, but the retainer releases by only light pressure of the thumb. The "nose" or chuck is bronzed square, preventing the chisel from turning and assuring longer life. One W" chisel to your specification or one chisel block is included with the tool. Write for complete data and specifications.

Help Finish the Fight
BUY U.S. WAR BONDS!

THE CLEVELAND PNEUMATIC TOOL COMPANY

2781 EAST 77TH STREET CLEVELAND 8, OHIO
BRANCH OFFICES IN ALL MAJOR CITIES

The CONE AUTOMATIC MACHINE COMPANY



sees many

GOOD THINGS AHEAD

It is reported that

The National Interregional Highway Committee and the American Trucking Association have agreed on the continuation of the schedules of truck sizes and weights accepted by the states for the war emergency. *Engineering News-Record.*

get ready with CONE for tomorrow

An electronic tube has been developed capable of amplifying grid currents as much as 500,000,000,000,000. *Chemical News.*

get ready with CONE for tomorrow

Two industrial plants have installed steam-heated sidewalks to make snow shoveling unnecessary. *Stam. Mfg. Co., Bethlehem, Pa.; Resalt Rubber Co., Bayville, N. Y.*

get ready with CONE for tomorrow

A compound called "2-4-D" is being tested on golf greens. It appears to be successful in selectively killing weeds without damaging the grass. *Science Digest.*

get ready with CONE for tomorrow

More than 200 industries, including the manufacturers of chewing gum, glass, synthetic rubber, drugs, cosmetics, paper and printing are finding that controlled heat and humidity (air conditioning) are essential to their work. *Wall Street Journal.*

get ready with CONE for tomorrow

A new laboratory exclusively for the study of jet propulsion fuels and lubricants has just been put into operation. *Wood River, Illinois.*

get ready with CONE for tomorrow

An electronic device fitted with a test pilot and aerial hook sightly instantaneous readings per second covering stresses, temperature and speed. *Controlled-Fuel.*

get ready with CONE for tomorrow

A new variation of the magnetic sand recorder uses a paper tape covered with powdered iron. It is claimed to be cheaper and more efficient than wire. *Radio & Television Monthly.*

Lace can now be made on a foundation of polyvinyl alcohol shewing which is easily dissolved after the weaving is done. *S. I. duPont duPont.*

get ready with CONE for tomorrow

An automatic headlight cleaner uses an "electric eye" to dim the lights on one car when the lights of another approach it. *Arrow Safety Device Co., Mt. Holly, N. J.*

get ready with CONE for tomorrow

Tetra Cetyl Silicate has been found far superior to water for the treatment of leak. By its use a temperature of 800 degrees could be kept around the house from a central tank and could be used to heat stoves, irons, water tanks, or small appliances. Connected in summer to a refrigerating plant, it could also cool the house. *Science Digest.*

get ready with CONE for tomorrow

One of the largest American drug manufacturers has set up a "golf farm" to experiment with the growing of drug plants that were formerly imported. *S. I. duPont duPont, N. Y.*

The Important SECOND



Modern production emphasizes the second, and more of the *Supraflex* Casomatic thick of parts like these in terms of seconds. The return of peace, and of peacetime production, will place even greater emphasis on the second — and on the importance of the Casomatic.



CONE

AUTOMATIC MACHINE CO., INC. • WINDBOR, VERMONT, U. S. A.

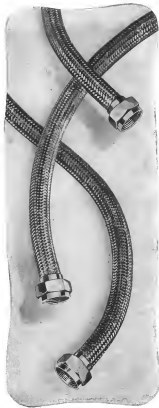
20

5-WAY THREAT in the Pacific

ONE OF THE NAVY's most effective offensive weapons is the Corsair, designed by Chance Vought Aircraft. Called the "5 in 1 Threat," because it operates as a land-based fighter bomber, land-based fighter, carrier-based fighter bomber, carrier-based fighter, and night fighter; the Corsair is one of the Navy's most versatile and powerful war planes.

Almost from the plane's inception, through its major improvements and modifications, Solar has collaborated in the design and supply of Exhaust Stacks.

Solar engineering and manufacturing skills in the fabrication of high temperature alloy products for handling hot gases and waste heat energy have led the aircraft industry since 1930. After Victory, they will be available to manufacturers in other fields.



For all auxiliary
wiring as well—

AEROCON
is the most efficient
shielding conduit

First developed to provide the most effective high-tension radio shielding, Aerocon flexible conduit continues to come into wider and wider use as shielding on low-tension systems.

Aerocon type 154 offers the special advantage of adaptability . . . It is available in any reasonable length—can be assembled in the field with standard AN nuts—or can be supplied in complete assemblies with nuts and lockwheels attached.

Aerocon proves to be thoroughly satisfactory because its special construction combines both excellent vibration-resisting and shielding characteristics. Aerocon is pressure-tight and eliminates the need for covering the conductor with a rubber sheath.

Titeflex Aerocon type 154, or its equivalent, is now specified by the Army and Navy whenever radio shielding of electrical wiring is necessary . . . Put your shielding problem up to the leaders in the field. Write fully to Titeflex.

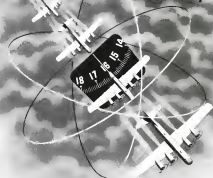
TITEFLEX, INC.
510 Fryinghousen Avenue
Newark 3, N. J.



Titeflex

MADE IN U.S.A.

Down an invisible road in the sky



There are no road signs as clouds, yet Allied forces, guided by electronic impulses, are daily arriving over the target after long flights over endless water. On accuracy in aerial navigation depends the success of a bombing run on Tokyo—and a safe return home. High-frequency impulses assure steady communication, and in landing planes and ships, and coordinate movements of aircraft, armies and ships. Delco Radio Division is proud of its contribution to find Victory through the development and production of compact mobile radio sets and highly specialized electronic and radar equipment. Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

Delco Radio
DIVISION OF
GENERAL MOTORS

WAR BONDS ARE FIGHTING BONDS

ATTENTION, August, 1941



HUCK Blind Rivets are unusually strong, safe and dependable—and economical, too, even on jobs where conventional rivets might ordinarily be used. The "inside" story of the way they work shows the reasons behind these advantages.

1 positive shank expansion At the start of the driving operation, the pneumatic rivet gun pulls tapered shoulder of pin through a smaller-diameter hole in the sleeve, positively expanding the sleeve to fill the hole. (Showing all right shows this step approximately half completed.) This creates a tight, full-groove-resilient joint capable of withstanding vibration and reversals of stress.

2 bulbed blind head formation Next, as the pull on the pin continues, the sleeve is squeezed between the head of the pin and the outer shell of the gun. The sleeve end spreads to form a bulbed head rather than flaring out into a tail head. This action pulls the sheets tightly together; also provides adequate surface contact between blind head and sheet, resulting in great strength and rigidity.

3 positive mechanical lock The inner shell of the rivet gun then automatically forces the locking collar of the outer shell of sleeve into the conical space shown at right, rigidly and permanently locking the pin to the sleeve. This positive lock gives the rivet a strength comparable to that of a solid rivet, also precludes all possibility of the pin working out.

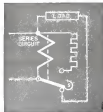
4 pin break, flush with head Finally, the pin is broken off in tension automatically flush with the head of the sleeve. There is no projecting end left to be cut off in a separate operation. . . The steps here outlined all automatically follow in proper sequence, and the whole driving operation requires only an instant.

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AVIATION, August, 1946

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AVIATION August, 1945

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AVIATION, August, 1945

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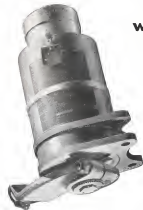
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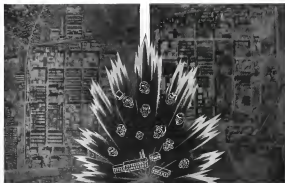
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BEFORE AND AFTER a B-29 "raid" on the Victor June 4 (circled) plant in Ohio. August 1945. (Left) before; (right) after the great world-wide Official Photo C-7, A-4, C-5.

LOST--

1 Aircraft Plant
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APRIL 1946, August 1946

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APRIL 1946, August 1946

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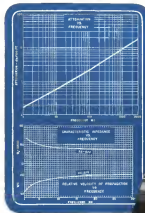
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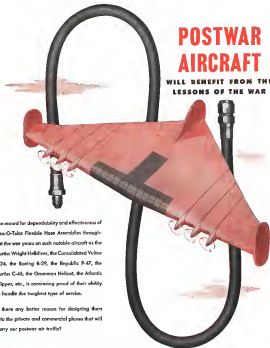
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AVIATION, August, 1946

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G-E INERT-ARC
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Fig. 1 is a series of cross-sections showing the penetration of the G-E inert-arc welding process.

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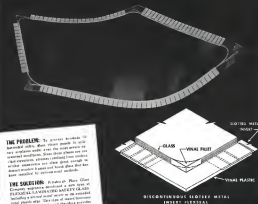
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GENERAL ELECTRIC

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NEW Metal Insert Prevents Glass Breakage



THE PROBLEM: To prevent breakage in laminated safety glass when made to such varying thicknesses, glass that is too thin or too thick is required. This glass then has to be ground, polished, and then coated with a special protective material. This material is then coated with a special protective material. This material is then coated with a special protective material.

THE SOLUTION: In order to have glass that is made to such varying thicknesses, glass that is too thin or too thick is required. This glass then has to be ground, polished, and then coated with a special protective material. This material is then coated with a special protective material. This material is then coated with a special protective material.

The accompanying diagram shows details of this new insert and the Pittsburgh Company's special PLUMBER, part of the new insert, which is a special insert in the glass.

THIS is typical of the unprecedented problems concerning glass and glazing which "Pittsburgh" has solved for airplane builders. Unsurpassed experience, methods and facilities have won leadership for Pittsburgh Plate Glass Company in the quantity production of airplane safety glass. If you would like further technical data on any aspect of safety glass for airplane glazing, write to us on your business letterhead. Address: Pittsburgh Plate Glass Company, 2109-S Green Building, Pittsburgh 33, Pennsylvania.

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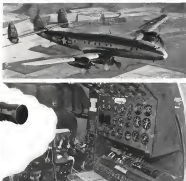
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AVIATION, August, 1948

JEROME Data CAMERA



Photo Courtesy of Lockheed Aircraft Corp.



A Check for the Flight Engineer

Still keeping his leg—the Flight Engineer today may rely upon a photographic record of instrument variations—kept accurately by the JEROME Data Type S&H and Motion Picture Interval Recording Camera. The resulting record is useful both as a back check and for permanent reference.

The JEROME Data Camera is designed for both still and motion picture work. Two shutters are provided, one for each type of operation. These mounting surfaces afford rigid anchorage and freedom from vibration.

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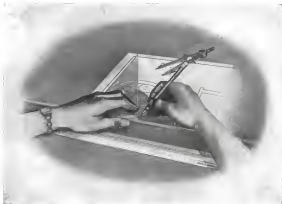
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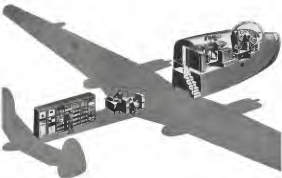
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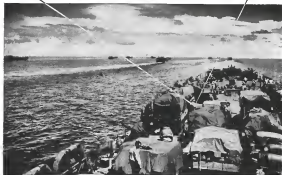
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